

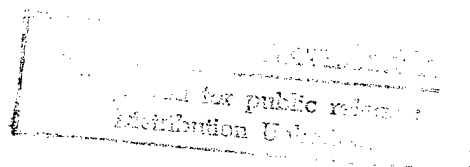
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Science & Technology

Europe

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ADVANCED MATERIALS

Second Phase of BRITE/EURAM Program Launched

92AN0057 Paris *ELECTRONIQUE INTERNATIONAL*
HEBDO in French 17 Oct 91 p 6

[Article by Frederic Fassot: "BRITE/EURAM Mobilizes Fr 4.5 Billion for the 1991-1994 Period"]

[Text] The second phase of the EC research program on materials is putting the emphasis on more industrial projects and on projects to help small and medium-sized enterprises (SME's).

Since the birth of the Basic Research in Industrial Technologies for Europe (BRITE) program in 1985 and of the European Advanced Materials (EURAM) program in 1986, which merged as BRITE/EURAM in 1989, almost 700 research projects on industrial materials and technologies have been carried out; 210 of those projects have already been completed. From 1985 through 1991, Europe will have invested a little more than 2 billion European currency units [ECU] (14 billion French francs) in these areas, half of which will have been funded by the EC. Of this multisector program's 151 projects selected for the single year of 1989, 15 related to electronic components and sensors.

"There has always been a gray area between BRITE/EURAM programs covering electronic materials and the European Strategic Program for Research and Development in Information Technologies (ESPRIT)," recognizes Ezio Andreta, head of the "production and materials technologies" division of the EC Commission. "Still, there is broad consultation between the two selection committees to direct the proposed projects toward the more appropriate program," he assures us. If the project applications are purely electronic, the project belongs in ESPRIT. Nevertheless, a project on brazing problems of high-capacity semiconductors in trains was selected for the BRITE/EURAM program.

Priority on Marketing Prospects

With a budget of ECU670 million for the 1991-1994 period, phase II of BRITE/EURAM will be directed more than in the past toward a distinctly industrial approach. Exclusively technological projects without visible commercial prospects will be turned down. Aside from a special aeronautical segment, the program will focus on two technical fields: Up to 47 percent of the budget will be devoted to raw materials, to new and improved materials and their processing, as well as to the recovery and recycling of industrial wastes—the latter objectives being related to environmental protection concerns. This effort should be of special interest to printed circuit manufacturers. The other technical field (up to 45 percent of the budget) covers design (new design methods, expert systems, databases, maintenance and reliability, mechatronics, microengineering) and

manufacturing (industrial use of advanced materials, high-quality manufacture of traditional materials).

Various types of projects can be submitted. Industrial research projects (77 percent of the budget) funded at 50 percent by the Community must be proposed by at least two independent companies from two member states. Projects require a minimum of 10 man-years over a period of two to four years, with funding varying between ECU1 and 5 million, the minimum share from industry being equal to two-thirds of the funding by the Community. The closing date for the first call for proposals is 28 February 1992. Ten percent of the program budget is for basic research; project funding is between ECU0.5 and 1 million.

R&D Opens to Small and Medium-Sized Enterprises (SME's)

The Cooperative Research Action for Technology (CRAFT) is a new initiative. With 9 percent of the budget devoted to it, it is addressed to SME's with R&D requirements, but lacking the structure to pursue them. Under CRAFT, SME's join forces and subcontract their R&D to third parties.

Projects can receive up to 50 percent in funding provided that their cost varies from ECU0.4 to 1 million, that they last a maximum of two years, and that they are proposed by at least two SME's from two different member states. Lastly, a feasibility study premium can be granted to an SME under BRITE/EURAM. The program funds 75 percent of the study, with a ceiling of ECU30,000 and a duration of nine months.

Danish Surface Engineering Center Presented

92WS0129G Stockholm *NEW SCANDINAVIAN*
TECHNOLOGY in English No 3, 1991 p 5

[Article: "Advanced Surface Engineering"]

[Text] At the Centre for Surface Technology—Dry Coating Processes, Danish industries and R&D centres co-operate on research and development. The partners are: NKT Research Center A/S, Grundfos International A/S, Danfysik A/S, Laboratory of Applied Physics/Technical University of Denmark, Institute of Physics/University of Aarhus, Materials Testing Department/Danish Technological Institute.

The centre was established in 1989 and is a part of the Danish Materials Technological Development Programme, the objective of which is to increase utilization in Danish industries of the most recent findings from research and development in the area of materials technology.

The centre is one of six centres established under the programme. The others work with plastic composites, powder metallurgy, ceramics, electroplating and surface reactivity.

The processes primarily dealt with at the Centre for Surface Technology—Dry Coating Processes are ion implantation, different types of Chemical Vapour Deposition (CVD) and Physical Vapour Deposition (PVD). The R&D work includes diamond and diamond-like coatings for tribological purposes. Furthermore, the work includes tribology in general.

The centre has set up a reference group of more than 100 participants interested in gaining access to the latest developments in the area of surface treatment of tools etc. Internationally, the centre has a number of contacts with foreign companies and R&D centres, and participates in international projects such as BRITE/EURAM, SPRINT, VAMAS and others.

Christen A Stracde, centre manager, gives a short description of the technical fields of activity:

"Detailed studies are carried out of the possibilities of producing diamond and other hard coatings by means of different CVD processes, together with studies of their applications. One important part of the work is to find ways of lowering the process temperatures for producing conventional CVD films and in this way widen the areas in which CVD coatings can be used. Another part of the CVD-studies is concerned with the new diamond, diamond-like and similar coatings with interesting characteristics. The problem is to obtain good adhesion to steel tools, low process temperatures and high growth rates."

"PVD has the advantage over conventional CVD in that the process temperature is much lower. It is easier to maintain fine tolerances on tools which are PVD coated. To obtain good adhesion of PVD coatings, however, it is important to clean and degrease the tools thoroughly before coating. An understanding of the mechanisms in the interface between the tool material and the coating will, however, also facilitate engineering of good coating adhesion. This is an important part of our work on PVD coatings."

"In the field of tribology, we hope to gain more knowledge of tribological conditions, with the object of facilitating optimum choices of surface treatment for tools. Equipment for simulating deep-drawing processes has been developed, and the centre possesses additional advanced equipment for simulating different tribological situations and for investigating materials and coatings, e.g. a Nano Intender."

The centre also works in the field of ion implantation, which was described in New Scandinavian Technology No. 1/1991. Besides working with ion implantation of tools and achieving a better understanding of the hows and whys of ion implantation, the centre also works with combinations of CVD/PVD processes and ion implantation. One of the aims of this work is to change film stresses and to increase film adhesion.

France: Memory Alloy Production, Development Reviewed

92WS0088B Paris *INDUSTRIES ET TECHNIQUES* in French 9 Sep 91 pp 43-46

[Article by Michel Le Toullec: "Don't Forget the Memory Alloys"; first paragraph is *INDUSTRIES ET TECHNIQUES* introduction]

[Text] Gadgets, some will say. Indeed. Memory alloys have already penetrated sectors such as connector technology, electrical and electronic household appliances, and the biomedical. On the positive side of the ledger, two principal applications: The actuating of a mechanism at a given temperature, and the interconnecting of mechanical parts.

Overwhelmed with remorse though they may be after having mistreated them, the paper clip maulers know full well that, try as they might, they will never succeed in restoring these unfortunate trombone-shaped bits of wire, victims of their owner's twitching nerves, to their original shape. Unless some day someone decides to do the necessary: Replace their vile steel with a memory alloy. These metallic alloys have altogether exceptional characteristics: The ability to recover their initial form even after significant deformation, and even the ability to change from their initial form to another as a function of temperature. A wire that is straight at ambient temperature transforms itself into a coiled spring at -10°C, and will recover its initial form as soon as it is reheated.

The characteristic memory of these alloys enables them, under the influence of temperature changes alone, to effect a displacement and/or exert a force that can be considerable and that is capable of actuating an entire device or mechanism. This peculiarity, which is the delight of the masters of Entertainment Physics, has already opened up applications for these alloys in the connectivity, military, building construction, biomedical, and electrical household appliance sectors. Note, for example, this magic fryer [photo not reproduced], whose basket lowers itself automatically when the oil reaches the desired temperature. It involves no automation whatever, except a blade of memory alloy. Paper clips, however, must still be patient....

50 Tonnes a Year; Europe's Largest Unit

"The nickel-titanium alloys were the first to be developed on an industrial scale," recalls Michel de Mendez, scientific director of Souriau and current president of the ADMMF [Association for the Development of Memory Materials]. "In addition to good memory, they offer the advantage of withstanding temperatures up to 300°C, and they develop a very substantial force during transformation. This phenomenon can be put to use between -200° and +120°C. Their first industrial application dates back to 1969. It consisted of hydraulic system couplings and seals, manufactured by the American Raychem company for the F-14 fighter plane." (Since then, Raychem has been considered the world leader in memory

alloys.) Unfortunately, these materials are still high-priced: Up to 10,000 francs [Fr], indeed Fr100,000, a kilogram! And difficult to work.

In France, they are being produced, since September 1991, by Memometal, which has taken over the nickel-titanium activity of Cezus (Pechiney Group). "With its production-line capacity of 50 metric tonnes a year, it will be Europe's largest manufacturer of memory alloys on an industrial scale," says Bernard Prandi, founder of Memometal and a former member of Cezus. "Memometal will not limit its activity to nickel-titaniums; it will also produce other memory alloys, such as copper-based alloys."

Potential Markets Include Automobile Industry

Copper-based alloys, representing the second generation of these products, were brought to market around the beginning of the 1980's. They are easier to work and carry a more reasonable price tag (Fr2,000 to Fr2,500/kg for wire or medium strip). "Copper-zinc-aluminum alloys can be worked on the same transformation lines as brasses," according to the research center operated by Trefimetaux, a producer of copper-based alloys. Their shortcomings, however, are their temperature limitation to not more than 140°C, and their poor mechanical strength. They are also quite sensitive to aging; that is, they gradually lose their memory. Recent newcomers are the copper-aluminum-nickel alloys whose transformation points can attain the record temperature of 200°C.

The French firm Ten, based in Saint-Herblain, has chosen one of the latter alloys for its famous intelligent deep-fryer, the most recent industrial development involving memory alloys. The alloy performs the function of a thermal actuator: At low temperature, the deep-fryer basket is held in the raised position by a support in contact with a memory alloy blade. At 170°C, the blade changes form, displaces the mentioned support, and allows the basket (and of course the fries) to lower into the oil at the proper temperature. The product has been patented by the Saint-Herblain-based company, which specializes in enameled household utensils. "To date, we have sold around 120,000 of them," says Patrick Lefeur, head of Ten's R&D activity, "a little less than we had hoped."

The product is sold at an intermediate price between that of the conventional fryer and that of its all-electric counterpart. SEB [Electronic Company of Boulogne], for its part, is currently developing, jointly with INSA [National Applied Sciences Institute] at Lyon and with Trefimetaux, what could eventually be actuators for several of its electrical household appliances.

Another system operating on the thermal-actuator principle is the Imago Company's "thermomarqueur" [thermal marker]. The La Ciotat-based company is the only one in Europe totally dedicated to memory alloys. The security device it has developed, barely larger than a credit card, makes it possible to monitor the operation of a refrigeration system throughout the duration of the

storage of deep-frozen products. At low temperature, a green ball appears, having been released by the contraction of a copper-zinc-aluminum alloy-based spring. The green ball indicates that storage conditions are normal. Should the temperature rise disturbingly, the spring expands to release a red ball that alerts the operator. "We have sold some 5,000 of them, principally to the scientific director subsidiaries of large supermarket chains," says Eric Weynant, Imago's director of science activity. "Our production line started up around the beginning of this year and will permit us to manufacture up to 30,000 thermal markers per month, depending on demand. Some of our thermal markers are designed to support safely the sterilization by radiation of the products with which they are associated. We have also developed a miniature thermal marker, about the size of a coin, designed for the monitoring of individual products. The system could compete with that of certain chemical patches currently in use."

Imago's approach—with its 18 employees, half of whom are engineers—is as original as its activity itself. It owns not less than a hundred patents, several of which concern production lines and especially quality control. It also owns a 30-percent stake in the Memometal Company. In addition, it conducts applied research in all sectors of potential interest from the standpoint of memory alloys, and especially in the household appliances sector, which, according to Eric Weynant, could very soon be "one of the most viable niches for these materials."

In building construction, the Axiome Company has patented a fire-stop ceiling system based on this same thermal-actuator principle. As soon as the temperature exceeds 60°C, a locking mechanism actuated by a copper-zinc-aluminum blade secures the false-ceiling panels so that they protect the conduits and isolate the floor above. Some 20,000 to 30,000 square meters of ceilings of this type are now ready for use, with the approval of the CSTB [Scientific and Technical Center for Construction]. This falls far short of Axiome's hopes. The problem is the system's cost, which, however, it is asserted, would benefit from the effect of scale if the building construction market decided to open its doors.

Another important function of these alloys is coupling and sealing. The coupling sleeves Raychem has been manufacturing since 1969 operate on this principle. Typically, a collar, machined to an inside diameter smaller than the outside diameter of the tubes it is to couple, is transformed and "expanded" at low temperature, so that it can be slid over the tubes it is to couple. When reheated, it seeks to recover its original diameter but is prevented from doing so by the diameter of the tubes. The result is a substantial force exerted by the collar and an effective coupling. This application is widely used in aeronautical and naval installations and in the oil industry. Nickel-titanium is used in this case, for its high resistance to corrosion under constraint.

The coupling function is used also in connector design and engineering, especially in the connectors developed

by Souriau, in which the female section, made of copper-zinc-aluminum alloy, opens and closes with temperature, releasing or firmly binding the male section as the case may be.

Many other applications have been devised conceptually, especially in the biomedical sector, although most of them have not yet found a market. Like the ingenious blood-clot filter designed to prevent embolization. Rectilinear in its low-temperature phase, enabling its insertion by means of a catheter, it opens like an umbrella at body temperature. "Nickel-titaniums are the only alloys that can aspire to accessing the biomedical domain, because their resistance to corrosion inside the human body is so much higher than that of the copper-based alloys," says Gabriel Pons, head of LETRAM [Materials Processing and Transformation Laboratory], a CEA [Atomic Energy Commission] group that has just recently hired a doctoral candidate, now preparing his thesis, to study nickel-titanium alloys that transform at ambient temperatures. Another advantage is that the reaction of tissues in contact with a nickel-titanium prosthesis stabilizes, as with stainless steel, within the first 3 months after implantation. There remains the problem of long-term toxicity: Metallic nickel is carcinogenic, but little is known about the alloy in this respect. "The very influential Food and Drug Administration has in every case opposed the use of nickel-titaniums for implants and recommends against their use for surgical instruments," says Michel de Mendez. "It approves them solely for dental bridges."

Most Recent Newcomers: Memory Steels

In the automobile industry as well, the emphasis is on potential markets. There is as yet no breakthrough. At the 1990 Automobile Show, Renault exhibited solutions whose incorporation in production models was several years away. A play takeup disk made of copper-aluminum-nickel was designed to compensate the difference in the coefficients of expansion of steel components and aluminum components in a gearbox. The project was developed jointly with INSA at Lyon and with Trefimetaux. The function required of the alloy in this case is to provide damping. Some Japanese car makers are banking on an open-and-close device for the motor's cooling system.

The automobile industry is also one of the engines driving the development of the latest family of materials: steel-based alloys, more commonly known as memory steels. "These materials have the considerable advantage of being decidedly less high-priced than their predecessors," says Bernard Dubois of the Ecole Nationale Supérieure de Chimie de Paris [Paris Higher National School of Chemistry]. They consist especially of the iron-manganese-silicon alloys, which are limited by their low resistance to corrosion, and of the iron-chrome-nickel alloys of the family of stainless steels, produced in France by Ugine. Their damping capability, which is greater than that of the copper alloys, could be

used, but undoubtedly not for another 10 years, in gearboxes and in some motors."

Therefore, a question arises: Why do so many projects not get past the prototype stage? Memory alloys raise very high hopes at their outset, but their performance all too often disappoints. The fault often lies with their designers. Experts on these alloys all agree: Why seek to innovate at any and all cost by using a memory alloy? Use of this material should not be considered unless the task it is to perform cannot be performed by another alloy. Why use it when a conventional bimetal would suffice? The potential user must also be aware that a memory alloy used under temperature and constraint conditions for which it is not designed will, in any case, not function for long. The engineers must learn to master the use of memory alloys, hoping that the researchers, for their part, will some day be better able to understand the transitions of phase.

A very positive sign, however, is that, contrary to what had been announced, Raychem does not plan to limit its memory alloys activity to the military sector alone. It fully plans to strengthen this activity in the direction of consumer market applications, with major focus on thermal and superelastic actuators. It is as though the world's number one believes in them more firmly than ever. The contrary would be discouraging....

France: IRMA Advanced Materials Center Opened

92WS0062A Paris COMPOSITES ET NOUVEAUX MATERIAUX in French 30 Sep 91 pp 1, 2

[Article: "Regional Advanced Materials Institute Opens in Brittany [Bretagne]"]

[Text] The Regional Advanced Materials Institute (IRMA) at Lorient was opened 20 September in ceremonies attended by Hubert Curien, minister for research and technology.

A technical center designed to serve industry, IRMA specializes in inorganic chemistry and materials (specialized glass, ceramics, catalysts). Established in July 1989 as an association under Law 1901, it was housed until just recently in temporary facilities. As an interface between research and industry, IRMA brings the benefits of research to all sectors of industry by developing new products (ceramics, glass, catalysts, composites, surface coatings, etc.), designing prototypes, offering scientific advice—everything from one-time consultations to project coordination (development and marketing)—and providing product control through physicochemical analysis.

In promoting the commercialization of research findings, the institute serves as a link between industries in the region and the basic research carried out at the Universities of Rennes, Nantes, le Mans, and Caen.

IRMA sometimes provides consultative services on a contractual basis at the request of the manufacturer. But in some instances the institute itself makes a proposal to the enterprise. In that case, its assistance can lead to improved performance of the company, product diversification or creation of a new enterprise. Financing may come entirely from the company or through the assistance of various partners: the Ministry of Research and Technology [MRT], ANVAR [National Agency for the Upgrading of Research], the regional council, etc.

As part of its service mission, IRMA develops various special technologies and once work on a particular system is launched conducts a study of its feasibility and economics. IRMA's projects cover all sectors of industry—especially chemicals, transport, electronics, construction and the mining industry—but without ignoring current issues such as environmental protection.

Technology Park

The choice of IRMA's site was a strategic one: the future Lorient Regional Technology Park. Located in the heart of an industrial "nursery," the site reflects Lorient's decision to use its know-how to develop a real center of expertise in the materials domain. It should not be forgotten that the Lorient region (in the heart of Bretagne-Sud) has no fewer than 24 enterprises and technical centers specializing in composite and new materials.

The facility was built under a planning contract between the state and region, so all property costs—10 million French francs [Fr] for the building itself and Fr7.2 million for the equipment—have been picked up by public bodies: the department of Morbihan (Fr6 million), SIDEREL (Fr5.7 million), the central government (Fr2.75 million), and Bretagne Region (Fr2.75 million). For its operating budget, IRMA currently relies on appropriations from MRT and the regional council, which are supplemented by payments it collects from various companies for contract work. By way of example, one may cite its development of the new material "innolithe" (this new porous material made from recycled glass is an outgrowth of research work done by the materials chemistry laboratory at Rennes I University), development and manufacture of a unique catalyst (IRMA is handling certain stages of the fabrication process for a new catalyst based on synthetic zeolite), and the development, in collaboration with IFP [French Petroleum Institute], of a process to reduce styrene emissions into the atmosphere.

Netherlands: DSM Effects 30 Percent Improvement of Dyneema Fiber

92P60069 Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 18 Nov 91 p 10

[Text] DSM, the Dutch chemical firm located in Heerlebe, has succeeded in effecting a thirty percent improvement of its polyethylene fiber, Dyneema, which

is already the world's strongest commercially produced fiber. This makes the fiber 15 times as strong as steel and twice as strong as aramid fiber. The new fiber is the result of innovations employing a patented manufacturing process called gel spinning.

Apart from its high specific strength, the new fiber has a high stiffness, while simultaneously exhibiting high flexibility. On the basis of these properties and its low specific weight—lower than 1, so that Dyneema floats in water—the material is especially suited for applications in which weight reduction plays a critical role, i.e., sporting goods and seagoing, ballistic and medical applications.

Moreover, the material should be extremely durable and resistant to moisture, ultraviolet radiation and a variety of chemicals. Owing to its elevated capacity for absorbing energy, the fiber is suitable for use in protective clothing and shock-resistant composite materials that must absorb high impact energies.

Swiss Institute Develops Nickel-Based Superalloy

92MI0010 Bonn WISSENSCHAFT WIRTSCHAFT
POLITIK in German 25 Sep 91 pp 6-7

[Text] The microstructure details that a nickel-based superalloy requires to give it its extreme strength have now been revealed in research at the Max von Laue-Paul Langevin Institute (ILL) in Grenoble. This research is a prerequisite for the targeted strength optimization of materials subject to maximum stress, such as those used in turbines.

As blades in aircraft or power station turbines, the materials used must withstand both working temperatures up to 1200°C and powerful forces without deforming, and have a long service life as well. Nickel-based superalloys are among the materials used for this purpose.

The superalloy currently under study at the ILL with the aid of neutron diffraction consists of a nickel monocrystal containing precipitations from a phase consisting of three parts nickel and one part aluminum. The shape and geometric distribution of the precipitations determine the material's strength.

In order to study the structure of this kind of compound with greater precision, the ILL filters a monochromatic beam of uniform speed and small diameter out of the reactor neutrons and directs it onto the sample of material. Because of its high penetration capacity, this kind of neutron beam is ideal for nondestructive materials testing. The neutrons are reflected in particular directions on the planes of the crystal lattice, a process called Bragg scattering.

In addition to the diffraction reflexes from the lattice of the crystal under study, which occur at wider angles, there are also others caused by precipitation crystallites at smaller angles. As a result, the scattered neutrons form

complex geometric intensity patterns, from which the shapes, sizes, and arrangement of the precipitations. The geometric distribution of the neutron intensity is recorded with a site-sensitive large area counter.

When the neutron intensity is sufficiently high, instantaneous photographs of the microstructure can be obtained in a few minutes.

This process will make it possible to identify elements detrimental to strength, or dislocations as they are known, in the crystals.

Swiss Institute Develops Nickel-Aluminum Superalloy

92MI0105 Duesseldorf *HANDELSBLATT*
in German 7 Nov 91 p 16

[Excerpts] The microstructure details that a nickel-based superalloy requires to give it its extreme strength have now been revealed in research at the Max von Laue-Paul Langevin Institute (ILL) in Grenoble. This research is a prerequisite for the targeted strength optimization of materials subject to maximum stress, such as those used in turbines. [passage omitted]

Metallic materials usually consist of single, irregularly arranged microcrystals, which may be of different chemical composition. A polycrystalline microstructure of this type often has a detrimental effect on the strength of the materials, as the high internal strength of the undisturbed crystal lattice is reduced at the interfaces. Certain monocrystals are therefore used in particular applications, such as jet turbine rotor blades subject to particularly high stress.

The continuous crystal lattice gives the material considerably higher strength. However, even these monocrystals generally contain weakening elements, which are known as dislocations. These linear or planar irregularities may migrate under the influence of external forces, as the atoms that they encounter are less strongly bound than those in the undisturbed crystal lattice.

Ultimately this migration entails a reciprocal displacement of whole lattice planes in the crystal and, consequently, a macroscopic distortion. This dislocation migration can however be blocked by obstructions, thus enhancing the strength of the real crystal. The technique achieves this purpose by embedding precipitations in the form of microcrystals of different chemical composition in the monocrystal lattice.

Snapshot of the Microstructure

The superalloy currently under study at the ILL with the aid of neutron diffraction consists of a nickel monocrystal containing precipitations from a phase consisting of three parts nickel and one part aluminum. The shape and geometric distribution of the precipitations determine the material's strength. The effectiveness with which the migration of the dislocations is blocked by the precipitations increases in proportion to the fineness of

their distribution, though they must have a certain minimum size and distribution density.

An exact knowledge of the morphological change that they undergo under targeted material processing conditions, e.g., during heat treatment, is a prerequisite for targeted strength optimization. The microstructure is examined by filtering a monochromatic beam of uniform speed and small cross-section out of the reactor neutrons and directing it onto the material sample. Owing to their great penetration capacity, neutron beams of this kind are ideal for nondestructive materials testing.

The neutrons are reflected in particular directions on the planes of the crystal lattice, a process called Bragg scattering. In addition to the diffraction reflexes from the lattice of the crystal under study, which occur at wider angles, there are also others caused by precipitation crystallites at smaller angles.

As a result, the scattered neutrons form complex geometric intensity patterns, from which the shapes, sizes, and arrangement of the precipitations can be determined. The geometric distribution of the neutron intensity is recorded with a site-sensitive large area counter. When the neutron intensity is sufficiently high, instantaneous photographs of the microstructure can be obtained in a few minutes.

The images show the intensity distribution of the scattered neutrons after heat treatment of varying durations, from which the microstructure of the precipitations can be determined. The precipitations are shaped like cubic crystals with blunted corners. The decrease in size of the diffraction figure shows that the precipitations increase in size as a result of convergence [Zusammenlagern] with the duration of heat treatment. Once the precipitations exceed a certain size, the observed convergence of smaller precipitation crystals with larger ones has an adverse effect on strength, as the number of obstacles in the way of the dislocations decreases.

Impetus for Users From Neutron Research

Mechanical expansion of the material also reduces strength. With tests of this kind, deformation of the precipitation crystallites from the original cubic shape to a flat structure has been observed. The ILL tests are an example of how neutron research, which was initially theory-oriented, is increasingly becoming a more applications-oriented tool and a pacesetter of modern technology.

The neutron-based study of the structure of matter is one of the tasks of the ILL, a joint venture launched by the Federal Republic of Germany and France in 1967. Each year around 1,700 visiting researchers use neutrons from its very-high flux reactor to conduct experiments.

AEROSPACE

ESA Decides on Future Funding

92WS0159A Milan *L'INDIPENDENTE* in Italian
20 Nov 91 p 20

[Article by Claudio Borgonovi: "Eurosace: The 12 Deciding How To Divide Up 80 Trillion"]

[Text] Munich—The European ministers of scientific research and technology are meeting in Munich to decide the timing and costs of future ESA [European Space Agency] programs. The Agency's space plan calls for an expenditure of 80 trillion [thousand billion] [lire] over the next 15 years, to which Italy will contribute 18 percent or 14 trillion. The issues being discussed include not only timing and costs, but also and above all, the distribution of the industrial returns of the programs among France, Germany, and Italy.

Space activities exert a pulling power on the technological and economic growth of an industrial society. Recent studies put a threefold value on the direct returns on investments in the sector, and a better than 14-fold value on the indirect returns. Europe has taken on a space role and has an ambitious plan: By the year 2005, it intends to have carried out an integrated program designed to guarantee its independent entry into space by way of automatic missions and manned spaceships. Of the 80 trillion lire to be invested during the 1992-2005 period, 12 percent will be allocated to basic research; 41 percent to the more commercial sectors such as telecommunications and remote sensing; and the remaining 47 percent to large-scale programs, such as the building of the new Ariane 5 rocket, which is scheduled to be operational by 1995 (at a cost of 6,400 billion [thousand million] lire); the Hermes shuttle (11,000 billion), similar to the U. S. Shuttle, and whose first flight is targeted for the year 2002; and the Columbus (7,500 billion), a permanent space station. The program itself is considered well balanced and capable of ensuring for Europe a competitive role in the sector, and is absolutely not under discussion. A growing discordance, however, has characterized relations among the principal European partners [France, Germany, and Italy], who alone provide 70 percent of the ESA funding and fully 80 percent of the funding for the three major projects. Germany and Italy are concerned over the excessive rise in costs, now up more than 40 percent over their 1987 level, and are proposing an approach based either on annual meetings devoted to a diligent audit of industrial activities or on the possibility of varying on a year-to-year basis the contributions made to the ESA, linking them to the industrial returns obtained. To date, France has played a key role in support of the European space effort, with contributions twice the size of Germany's, and three times the size of Italy's. In exchange, it has received a broad share of the ESA industrial contracts and virtually total control of ESA activities.

This has enabled French companies to take over majority shareholder control, and hence to manage the industrial policy and the distribution of profits, of the private-sector enterprises to which the ESA contracts out the marketing of operational programs, such as Arianespace for the marketing of the European Ariane rockets, which over the past 10 years has amassed the very respectable billing total of around 7,500 billion [lire], which is 50-percent controlled by trans-Alpine companies, and 7 percent by Italian companies.

Whatever the conclusions reached at this meeting, they are likely to conflict with the recent EEC-EFTA [European Free Trade Association] agreement relative to the creation of a European economic bloc. The four freedoms guaranteed by the agreement—movement of persons, assets, capital, and services—are in actual fact limited by the ESA's rules of operation, which do not take into account the competitiveness of individual firms, as recommended by the EEC Commission on Competitiveness in Aerospace Activities, in October. There is also the risk that Europe will end up having developed a sector whose fruits will have been reaped by others.

For example, of the 115,000 billion lire that are to be spent on space telecommunications over the next 10 years, over 80,000 billion will go into the construction of earth receiving stations, of which Japan is the world's principal builder, although it has an extremely small-scale space program of its own. As pointed out by Andrea Pucci, managing director of Alenia Spazio, the leading Italian firm in the sector, "We must avoid becoming a dumping ground and being relegated to the fringes of the sector. To be competitive, we must offer a complete system including satellites and earth stations. Of the Italian firms, Alenia is the one most affected by the decisions being made at the summit in Munich, insofar as concerns both its share of the Columbus program and its role as prime contractor for the DRS [data relay satellites], an advanced telecommunications satellite system that will cost 1,200 billion lire and which Italy is financing to the extent of 48 percent. BPD, of the Fiat Spazio group, the sector's other Italian industrial giant, is present only in the Ariane 5 program, which is nearing completion and will therefore not be directly affected by the decisions reached. On the other hand, the launching of its own San Marco Scout program, for the development of a small national rocket, is designed to provide Italy with some degree of independence with respect to European programs, whatever they may be.

Belgian Position at ESA Ministers' Conference Outlined

92AN0073 *Bijgaarden DE STANDAARD* in Dutch
18 Nov 91 p 6

[Text] At the Ministers' conference of the 13 European Space Agency (ESA) countries, being held in Munich today and tomorrow, our country is pleading for the continuation of the current programs, including the

construction of the Hermes European space shuttle. This will allow Europe to develop its autonomy in space and to prevent the loss of past investments, according to Minister of Science Policy Wivina Demeester.

In order to meet the heavy ESA commitments (for Belgium an expenditure of 5 billion Belgian francs (BF) per year), an appeal will be made to a special fund, still to be established, which will be added to the resources made available by the government.

As the costs of the Hermes and Columbus programs in particular are rising ominously, our country is asking that the growth of the ESA budget be limited to 10 percent. Belgium's contributions to the ESA programs already cause a disproportionately large share of the budget for science policy to be spent on aerospace.

Contrary to her predecessor (Secretary of State Derycke), the current minister of science policy—appointed to this function only six weeks ago—does not plead for a drastic reduction in Belgian contributions and a curtailment of ESA programs.

Belgium's role in European scientific collaboration is highly valued and we must not lose our favorable reputation, said Minister Demeester. Moreover, the ESA programs are of great importance for Europe's autonomy in aerospace and technology.

Efforts already made must on no account be wasted. Furthermore, a possible reduction for financial reasons would put us behind to a degree which would be even more expensive to make up.

Hermes is a space shuttle in which Europe wants to put its own astronauts into orbit around the earth by the beginning of the next century. Its development has encountered technical difficulties and is overrunning its budget.

The first flight will therefore not take place before 2003, a few years later than originally planned.

Columbus consists of a manned station which will be linked to the U.S. space station. For this project, too, the budget has been exceeded. Ariane 5 is a heavy rocket which will launch Hermes among others. Until now, its development is going as planned.

The start of this triple program was decided upon during the last Ministers' conference in The Hague in 1987. All ESA countries concurred with the decision, except the UK, which does not participate in Hermes and Ariane 5.

Threat

Belgium committed itself to take on 5.8 percent of the expenses for Hermes, 5 percent for Columbus, and 6 percent of the cost for Ariane 5. This meant an expenditure of BF4.1 billion in 1991. In 1992 this amount will rise to BF5.2 billion. As a result, the share of aerospace in the budget for science policy amounts to no less than 60 percent.

The ESA credits therefore threaten other scientific research projects in Belgium.

In order to relieve public spending without jeopardizing the continuation of the ESA programs, Mrs. Demeester wants to establish a special fund, which would be able to use alternative methods and sources of funding. Industry would be able to contribute to this fund. It would be possible to extend participation over a large section of industry instead of reducing it to the companies directly linked to the ESA programs.

Since there is already a shortage of over BF500 million in next year's projected budget, the fund should be established as soon as possible after the formation of the new cabinet. By tapping new sources, sufficient means should become available for our country to meet its ESA commitments without jeopardizing other scientific programs.

USSR's Soyuz To Carry French Biological Experiments

92WS0068A Paris AFP SCIENCES in French 3 Oct 91
pp 14, 15

[Article entitled: "French Biological Space Experiment on a Soviet Photon"]

[Text] Moscow—A French biological space experiment, dubbed SEDEX, was to be launched into orbit around the Earth on 4 October, for two weeks, aboard a Soviet Photon satellite. The latter was launched by a Soyuz rocket, from the Plesetsk (Russia) space base. Metallurgy experiments devised by the Soviet laboratory Splav will be run aboard the same satellite.

SEDEX is a dextran biosynthesis experiment to test the activity of the dextran-invertase enzyme at the microscopic and macroscopic levels under microgravity conditions.

The French company Novespace, a subsidiary of the National Center for Space Studies (CNES), paid 225,000 dollars to send the 15 kilos of apparatus and experimental equipment for the SEDEX experiment into flight. Novespace benefited from its privileged contacts with Glavcosmos, the organization that markets Soviet space flights. All the experiments will be recovered during the second half of October.

French participants in the experiment include BioEurope (a Toulouse small company), Matra-Space (which built the SMILE mixing device), the CNES, Comat (which furnished the enclosures and the command system), and Novespace. The Soviet side is represented by Glavcosmos and KB Photon, the company that manufactures the satellites and especially their recoverable capsules.

By understanding the mechanisms involved in the synthesis of dextran, biologists hope to comprehend the functioning of the only enzyme, dextran-invertase, that

is capable of synthesizing a polysaccharide in vitro. Polysaccharides have numerous biomedical applications, some in the fields of nutrition and dietetics, and can be used, notably, as substitutes for blood plasma.

This is the first time that Novespace has flown an experiment aboard a Photon satellite under its cooperation agreement concluded with Glavcosmos just over a year ago. Negotiations are in progress to prepare other flights in 1992-93. Other possibilities include participation in joint American-Soviet satellite flights or in manned Soviet missions that are under discussion.

Novespace has held several discussions with the Chinese concerning the use of their technological satellites, but for now these have not borne any fruit. "With these flights we are learning our profession and preparing the missions we will undertake in the modules of the future European space station in the next century," Mr. Jean-Pierre Fouquet, of Novespace, told the AFP (French Press Agency).

France Plans Development of Small Satellite Launchers

92AN0021 Paris SCIENCES & AVENIR in French Oct 91 p 16

[Text] With the miniaturization of electronic equipment, a promising market is opening up for small-scale satellites. The French National Center for Space Studies (CNES) is considering developing one or more launchers based on technologies developed to build the Ariane 5 rocket. Ariane 5 will be flanked by economically reusable "P-230" powder boosters.

Two preliminary projects have been launched. The first entails placing on the P-230 a vehicle composed of three stages: a P-85, a P-30, and an L-5 stage—i.e., two stages to carry 85 and 30 tonnes of powder, respectively, and one stage which will contain 5 tonnes of liquid—to put approximately 5 tonnes in low orbit. The second project will use quite simply this three-stage vehicle to launch approximately 1.5 tonnes.

German/Soviet Project for Hydrogen-Fueled Aircraft

92WS0079A Munich HIGHTECH in German Oct 91 pp 72-73

[Article by Erny Hildebrand: "Revving-Up for an Uncertain Goal"; first paragraph is HIGHTECH introduction]

[Text] In an unusual German-Soviet project, aviation engineers are working on the development of an aircraft powered by hydrogen. The "cryoplane" is expected to take off as early as the turn of the century.

During the time of the strictest Cocom-controls, such a project would simply have been unthinkable. Even today such agreements are quite unusual in this field. German-Soviet cooperation in the development of an aircraft using cryogenic fuels is presently viewed with complete

skepticism by the U.S. aviation industry. But this does not disturb the participants in this spectacular undertaking in the least.

Under the direction of Deutsche Airbus GmbH, companies like Tupolev aircraft in Moscow, the Kuznetsov engine plant in Samara, Messerschmitt-Boelkow-Blohm GmbH (MBB), and the Motor- and Turbine-Union GmbH (MTU) of Munich have set about the realization of a project whose end result will be an alternative to the present-day kerosene-powered aircraft. If everything goes according to plan, a number of cryoplanes will be taking off by the beginning of the century. Following the introduction of cryoplanes, the developers believe that both the problem of the diminishing oil supply—expected to be depleted in 30 to 40 years—, as well as the problem of environmental pollution caused by kerosene will be resolved.

As far as the technical development is concerned, Rolf Volkhausen, project director at Deutsche Airbus, sounds very optimistic: "We are right on schedule." The feasibility study, on which Dornier GmbH, Lufthansa AG, Fichtner GmbH, Linde AG, MAN Technologie AG, the Max Plank Institute of Hamburg, Messer Griesheim GmbH, and Moscow's NIAT Institute (Scientific Research Institute of Aviation Technology) are also participating together with the main partners, is expected to be finished in the Spring of 1992. Presently, a methane-, a hydrogen-, and a combination methane-kerosene aircraft are in close competition. Unlike conventional aircraft, all three varieties will carry their tanks on the fuselage rather than in the wings.

"What is most important," the Russian Alexander S. Shengardt notes in describing the first stage of development, "is that we now are aware of all problems connected with the design and development of the cryoplane. As the chief designer of the legendary Tupolev TU 154, he has dedicated 15 years of his life to the development and testing of one of the first prototypes of a hydrogen aircraft. Meanwhile he is now 65 years old and is especially happy that it has now become possible to cooperate with Western partners. "The Cocom List would have made Soviet production impossible," Shengardt emphasized, "even though we are the real pioneers in the development of a hydrogen aircraft."

If the 10 to 20 specialists working on the feasibility study come to a positive conclusion, the joint-venture partners want to initiate preliminary development as rapidly as possible and develop a flight-capable aircraft for demonstration purposes. Soviet tests with the TU 155 were quite insufficient, according to Airbus-developer Volkhausen. He recommends converting an Airbus A 310 as a test machine.

The space industry has already provided additional flight experience based on hydrogen. To be sure, technical imponderables and environmental problems still occupy the scientists's minds. "Since the tanks rest on top of the fuselage, we are currently investigating how we

can reinforce the fuselage side walls so that the additional weight can be carried on back of the fuselage," project director Volkhausen notes as only one of the problems to be resolved. Moreover, it is still not clear just what tools and devices have to be developed for the new construction.

Finally, the question of a better ecological acceptance has not yet been solved. "Even if the hydrogen is recovered from natural gas and the flight is very sparing of the environment, the hydrogen used for this purpose has already blown in to the atmosphere during production, so that nothing much is gained," Volkhausen observes as one of the critical factors that would have an economically unfavorable effect. For a CO₂-tax, which would be likely, would drive the cost of hydrogen up as high as for kerosene, which releases 3.1 kilograms of CO₂ for every kilogram burned. Another controversial factor is the expulsion of steam. When one kilo of kerosene is burnt, 1.2 kilos of steam is expelled. If hydrogen is used as aviation fuel, then 2.7 times more steam is expelled. Scientists at the Max Planck Institute in Hamburg have already reported that this vapor release is indefensible, because as a hothouse gas it would accelerate the hothouse effect even more.

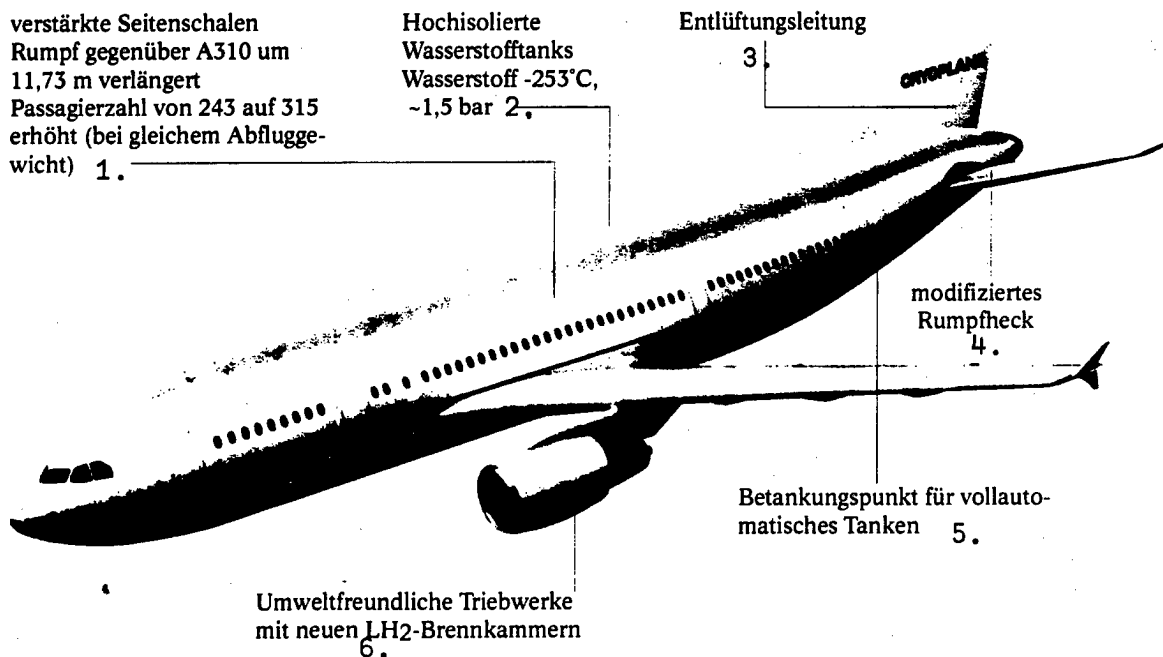
Despite such unresolved questions, Volkhausen remains confident. "I am firmly convinced that one day all

aircraft will fly on hydrogen, because, unlike oil, hydrogen is inexhaustible on the planet," he states, casting an eye to the future. He is equally confident in the cost-effectiveness of the new aircraft. "Just as soon as the price of kerosene has climbed to 2.50 German marks [DM] because of the impending shortage," Volkhausen predicts, "hydrogen will become more attractive, even if the entire infrastructure has to be converted."

Taking the Hamburg Airport as an example, he has made a cost-benefit analysis. He estimates that the conversion of the airport would come to DM500 million and establishes a 20-year depreciation period. To cover the costs, each of the five to six million air passengers that use the airport yearly will have to pay about ten marks more for his ticket. Volkhausen believes this to be a reasonable burden.

In the opinion of aviation experts, the introduction of the hydrogen engines will again completely redivide the aircraft market. "As soon as we have firm ground under our feet, we want to approach the Airbus industry," Volkhausen states, thereby forging plans to expand the German aircraft industry to a European project. Besides Germans, French, British, Italians, and Spaniards, the Soviets too would participate in a future joint-stock company. In return, the enormous Russian market would become available.

Clean Flight With the Fuel of the Future



This is how the Airbus A310 will look when powered by hydrogen

Key: 1. reinforced side walls; fuselage 11.73 m longer than A310; number of passengers increased from 243 to 315 (with same takeoff weight)—2. highly insulated hydrogen tank; hydrogen -253°C, -1.5 bar—3. ventilation duct—4. modified aft fuselage—5. fueling point for fully automatic fueling—6. environment-friendly engines with new LH₂ combustion chambers

Propellant Valve Assembly Improves Ariane 5's Fuel Efficiency

*92WS0069C Duesseldorf VDI NACHRICHTEN
in German 27 Sep 91 p 33*

[Article by Norbert Schmidt: "With Swabian Specialties to the Stars: Servo Technology Must Function Reliably; Electrohydraulic Valve Successful in Space"; first paragraph is VDI NACHRICHTEN introduction]

[Text] In the midst of the machine tool industry's model state, the American Moog Inc. made itself at home 25 years ago. Perhaps it was also proximity to the automobile industry's hub in Stuttgart that attracted the electrohydraulics manufacturer to Swabia. IBM and Hewlett-Packard also settled in Boeblingen. Good for the community's trade tax receipts and good for the economic structure of Baden-Wuerttemberg. A model case of industrialization.

Special solutions for the user, this is where Moog GmbH sees its strength—and the reason for its economic success over the last 25 years. All assignments not expected to run to larger series production, which are of no interest to mass producers, are especially interesting to Moog.

"When Bill Moog presented his plans for a production plant in the Huh industrial area in 1965," remembers Alexander Vogelsang, mayor of Boeblingen, "he assumed an employee number of eight to ten for the start-up and 100 to 150 at maximum growth." It pleases Vogelsang all the more that 400 people are employed today at a total of three plants in Boeblingen, since his city coffers profit from the trade tax. The city father evaluates Moog's position rather positively when he cites Moog in third place after IBM and Hewlett-Packard.

While the other two American multinational corporations in Boeblingen are generally well known because of their products, "almost every citizen has a connection to Moog products without realizing it," says Kenneth G. Smith, director of the GmbH, regretfully. Indeed, who knows that the bumpers of his automobile were made with machines which used Moog proportional valves in position and speed control systems.

I also remains concealed from the frequent flier that Moog servovalves are used as control elements for the actuators in the primary flight control (rudder) system. Since the delivery of the first valves in 1985, variants have appeared for 14 different applications in the airbus families.

If use in civilian aircraft construction counts as a proof of reliability, then the Ariane project is the pinnacle. It will still be a while before the Moog valves have to show what they can do. The Ariane-5 launch vehicle is supposed to be available in 1995 for heavy payloads. But the tests have already been passed. The Propellant Valve Assembly (PVA) component is part of the propulsion system of the final stage L-7 of the Ariane-5 launcher and is responsible for optimal fuel supply for the 27.5 kN

thruster based on pressure and rate of flow. In addition, the PVA is also responsible for interrupting fuel flow as well as for purging the engine of fuel residues after shut off.

The PVA module consists of two pneumatically actuated fuel valves, a pilot valve for each fuel valve, a pneumatically actuated blow-off valve and a check valve. While the monomethyl hydrazine and nitrogen tetroxide fuel supply is regulated by pneumatically actuated fuel valves, electrically actuated pilot valves are responsible for their control.

The fuel valves open and close through electrical impulses to the coils of the pilot valve. The same process also controls the blow-off of fuel residues. The PVA is stable in both switching positions, and the switching impulse is only on for a short time. Thus Moog was able to minimize energy consumption.

Along with fuel supply, specialists at the ESA [European Space Agency] have also placed the attitude control system of the Ariane 5 rocket's final stage in the hands of the Boeblingen firm. The electromechanical actuator controls the flight path of the rocket. The direction of the thrust vector is controlled by two independent actuators, both placed at 45° to the pitch and yaw axes. The reliability demanded of these elements is so high that each actuator is equipped with a redundant duplex drive which can assume full function in case one drive channel fails. The "operating conditions" of the actuators are also not ordinary. They must withstand temperatures of up to 250°C. According to the Moog developers, brushless motors contribute in particular to high reliability.

Italian Industries Assigned European Aerospace Contracts

Expert Systems

*92MI0123A Rome AIR PRESS in Italian
2 Oct 91 p 1958*

[Text] Fiar, of the IRI [Institute for the Reconstruction of Industry]-Finmeccanica group has developed a real-time expert system to plan and monitor the operations of Olympus, on behalf of the ESA [European Space Agency]. The system was delivered to ESOC [European Satellite Operations Center] on 13 August for use in online connections with the Multi Satellite Support System and an Olympus simulator.

Essope consists of: a knowledge acquisition tool which permits the operations controller to plan the flight operations program through its knowledge of the satellite's architecture; a planning/scheduling tool which examines requests from users and the operations control center and produces a weekly detailed operations schedule; an execution monitoring tool that assists the satellite controller in verifying that operations have been executed, rescheduling, and in dealing with any anomalies in the satellite's operations. Many features of Fiar's expert system make it reliable and easy to use. These include

the object-oriented architecture of the entire satellite, the definition of the flight operations plan using both natural language and coded instructions, a graph system to generate operations starting with payload and subsystem architecture, a structural approach for the solution of planning problems, a reasoning method that incorporates time, operating, and resource schedules, ability to replan in case of anomalies in the satellite's operation.

Fiar states that: "Essope can be easily adapted to automatically manage other scientific and telecommunications satellites, such as Italy's SAX satellite, and reduce satellite operating costs considerably," and has expressed the hope that, "it will be well received by builders and operators of earth stations."

Infrared Sensors

92MI0123B Rome SPAZIO INFORMAZIONI
in Italian 2 Oct 91 p 6

[Text] Officine Galileo (EFIM [Manufacturing Industry Holding and Financial Company] Finbreda group) was recently assigned a large contract by MBB [Messerschmidt-Boelkow-Blohm]/Erno-Aerospaziale industrial consortium, worth roughly 6 billion lire for the supply of eight infrared sensors to be used on the future Turksat and Eutelsat telecommunications satellites. The sensors, which will measure the satellites' attitude while in geostationary orbit, have already been used in other national and foreign programs such as Italsat, ECS, Skynet, Inmarsat, and Olympus.

Mars Mission

92MI0123C Rome SPAZIO INFORMAZIONI
in Italian 2 Oct 91 pp 6-7

[Text] Paris, 2 October—The ESA [European Space Agency] has recently assigned the MarsEMS1 research contract to a European industrial consortium composed of France's Aerospaziale, Italy's Alenia Spazio, Germany's MBB [Messerschmidt-Boelkow-Blohm]/DASA [German Aerospace Corporation], and the UK's British Aerospace. The contract concerns defining the future manned mission for the exploration of Mars. Under this contract (worth approximately ECU250,000, and lasting one year) Alenia Spazio will be responsible for simulating all the operational and logistic phases of the Mars mission both on Earth and in space, the profile of the interplanetary flight, and any procedures to create artificial gravity within the shuttle.

Cluster Satellites

92MI0123D Rome AIR PRESS in Italian
9 Oct 91 p 2061

[Text] Laben of the IRI [Institute for the Reconstruction of Industry]-Finmeccanica group will design and manufacture the computerized system that will oversee operations on board the four Cluster satellites to be launched in fall 1995 with the Ariane 5's second flight. Laben's contract falls under the STSP project on solar-terrestrial

interference, which the ESA [European Space Agency] has assigned to Germany's Dormier. The computer on board the Cluster satellites consists of four units and is constructed to withstand cosmic radiation. It has a total memory of 380 Kbytes, and will cost approximately 27 billion lire, almost 10 percent of the satellites' entire cost. The computer will collect scientific data on experiments and check the satellite's vital parameters. The program first involves the launch of the SOHO satellite to study the effects of solar wind on the Earth's magnetosphere. The purpose is to improve Earth-satellite transmission and acquire more knowledge of plasma physics, useful for nuclear fusion.

Italian Consortium To Build Steel Structures for ESO Telescope

92WS0068B Paris AFP SCIENCES in French 3 Oct 91
p 19

[Article entitled: "Three Italian Companies Will Construct the Basic Components of the VLT"]

[Text] Paris—A consortium of three Italian companies will build the main mechanical structures of the four components that will make up the VLT (Very Large Telescope) of the European Space Observatory (ESO) around the year 2000.

The ESO announced that the contract for the basic components of the four telescopes, which will measure 8 meters in diameter and weigh over 440 metric tons each, was signed 24 September between the Observatory, in its headquarters in Garching (Munich), and the AES Consortium. The latter is composed of Ansaldo Componenti (IRI Finmeccanica group), EIE (European Industrial Engineering), and SOIMI (Societa Impianti Industriali, of the Asea-Brown Boveri group).

The steel structures will be preassembled and tested in Europe, then transported by the AES Consortium to the Observatory site at the summit of the Cerro Paranal (2,650 meters in altitude) in the Chilean desert of Atacama 130 kilometers to the south of Antofagasta. AES will also handle the assembly and final testing of the components. Fabrication will begin in mid-1992. The structures of the first of the four telescopes will be delivered to the ESO, on site, at the end of 1994.

The eight member countries of the ESO (Germany, Belgium, Denmark, France, Italy, the Netherlands, Sweden, and Switzerland) decided to build the VLT in 1987. The installation will consist of four telescopes, each 8 meters in diameter, that can be used either separately or at once. The whole structure will then be equivalent to a telescope with a 16-meter diameter, making it the largest telescope in the world. The first telescope will be available in 1995 and the whole set in the year 2000. Construction of the mirrors has been assigned to the Germany company Schott and their polishing to the French firm REOSC.

Ansaldo Componenti and EIE already played a major role in the construction of the New Technology Telescope (NTT), a 3.50-meter instrument belonging to the ESO that has been operating for two years on the La Silla mountain (altitude 2,400 meters). The mountain is located in the southern part of the Atacama desert, 600 kilometers from Santiago. The two companies built the telescope's octagonal, revolving cover as well as the housing, located under the mirrors, of the "sensors" that allow the telescope's curvature (active optical and adaptive) to be monitored and corrected by computer. In addition, EIE is taking part in the study of the protective domes for the VLT's four telescopes.

Another Italian consortium, led by Ansaldo Componenti and also including the CRIV Company and INNSEI is currently building the Galileo telescope for Italy. Galileo will have a diameter of 3.50 meters and will be modeled on the NTT.

Luxemburg's Astra Telecommunications Satellite Wins European Dominance

92WS0069D Duesseldorf VDI NACHRICHTEN
in German 20 Sep 91 p 23

[Article by Gerd Krause: "Astra Satellite Beams Victoriously in European Skies: Luxembourg's SES Obtains Third Program of North German and Bavarian Broadcasting Corporations, European HDTV [High-Definition Television] Plans in Turmoil"; first paragraph is VDI NACHRICHTEN introduction]

[Text] The launch of the first Astra in 1988 did not take place under a lucky star. Technicians were skeptical about the design of the Medium Power Satellite, and zealous analysts were already predicting its speedy demise. Nevertheless, the private satellite from Luxembourg won Europe's satellite competition.

"About 26 million television households throughout Europe watch Astra programs," Dr. Pierre Meyrat, head of Luxembourg's Astra satellite operator SES, announces proudly. Most receive them via hookups to postal administration cable networks, and about 4 million households rely on direct reception with a satellite antenna. The Hamburg market research institute Gfmgetas has determined that there are 10 million Astra households in Germany, Austria, and Switzerland, 1.5 million of them with direct satellite reception. This makes Astra the most successful European satellite system, as SES head Meyrat can confidently state. "If this rapid development continues, by the end of 1991 we will be able to supply more than three million households in Germany alone via Astra," says Meyrat enthusiastically.

The success to date stimulates the Luxemburgers to further entrepreneurial initiatives. Two additional satellites are to follow the successful launch of the second Astra satellite, 1B, in April of this year. Astra 1C and 1D, the latter with HDTV capability for transmission of motion picture-quality television broadcasts, have

already been ordered from Hughes Aircraft. Arianespace, the French operating company of the European launch vehicle Ariane, will put them into orbit in 1993 or 1994. Like the Astra 1A and 1B satellites, the newcomers will also be copositioned at 19° east. That means all Astra programs will continue to be received with a single parabolic antenna at the same orbital position. The Astra system is supposed to be designed in such a way that the viewer with a single 60 cm satellite dish can receive up to 48 television and radio programs. At present, there are 24 television and 21 radio programs which households can receive via Astra. "The private programmers want Astra," emphasizes Ursula Adelt, director of the Private Broadcasting and Telecommunications Association in Bonn. Not only the private ones. Effective September 15, 1991, NDR [North German Broadcasting Corporation] began broadcasting its third program on Astra, a contract with the Bavarian Broadcasting Corporation will soon be signed, and negotiations with additional public broadcasters are already well underway, reported Astra spokesman Yves Feltes. Frank Mueller-Roemer, technical director of the Bavarian Broadcasting Corporation, is sure that's not enough: "The main programs of ARD [German National Broadcasting Corporation] and ZDF [Second German Television] will also have to go via satellite soon. In order to achieve a certain range, I, too, think of Astra."

Only a few years ago, nobody would have thought a private satellite operator could succeed, because satellite television was primarily a government concern. By the middle of the seventies, there was already an enormous problem in the world of European television; even at that time there was a drastic shortage of terrestrial frequencies. Space provided the solution: The idea of direct broadcast satellites (DBS) was born and, with the progress of technology, brought within reach. With DBS, television programs can either be fed into households via the postal service's public cable network or received directly by viewers with a parabolic mirror.

The national postal administrations of the International Telecommunication Union (ITU) went to work purposefully and met in Geneva in 1977 at WARC '77 (World Broadcasting Satellite Administration Conference). Orbital positions, frequencies, channels, and polarization for direct broadcast satellites in Europe were equitably distributed, each country being assigned five frequency ranges. The telecommunications officials took into consideration the status of technology and set transmitting power for future satellites at 58 to 62 dBW [design bandwidth]. The national postal administrations thus had a well-considered plan for conditions at that time; future satellite operators were assured of five satellite television channels per country.

However, in 1980, France and the Federal Republic of Germany entered into an agreement on the joint construction of DBS with high transmitting power; the transmission standard at that time was not yet established. However, when European plans for high definition television, HDTV, took shape in the middle of the

eighties and the European television manufacturers Philips and Thomson opted for the D2-MAC [Definition 2 Multiplexed Analog Component] standard as the transition to real HDTV, the EC also decided in favor of D2-MAC. The EC guidelines adopted in 1986 stipulated that all direct broadcast satellites after the WARC agreement transmit programs in D2-MAC, thus paving the way for the final broadcasting standards for motion picture-quality high definition television.

The national postal administrations had bad luck with their satellites at first. Technical and political problems delayed the construction of the new DBS. In 1988 the German TV-Sat 1 of DBP Telekom took off for the flight into the new future of television, but then proved unable to function and since that time has orbited as maimed space scrap. Its successor TV-Sat 2 was shot into orbit in 1989 and provides the region of the Federal Republic with D2-MAC programs. The French satellites TDF1 and TDF2 of France Telecom, which were put into orbit in 1989 and 1990 respectively, are intended for the region of France.

But meanwhile SES arrived and the success of Astra threw European plans for motion picture-quality high definition television, HDTV, into disarray. Legally, the MAC requirement applied only to direct broadcast satellites planned after the WARC agreement. As a so-called Medium Power Satellite, Astra does not fall into this category. The Luxemburgers slipped through this legal loophole and transmitted from the start in PAL [Phase Alternation Line]—with success. Soon after the launch of SES's first Astra satellite in 1988, the allure for programmers and consumers became evident. Private broadcasting corporations were the first to risk the move to the economical private satellites. However, at first nothing came of the dream of high flying national DBS with high definition television.

Fourteen years after WARC '77, a man looks out the window in an old castle in the town of Betzdorf, Luxemburg, and puffs contentedly on his pipe. "The postal officials in Geneva had no idea," summarizes Pierre Meyrat calmly. The concept of direct broadcast radio satellites seems to have failed for the time being. Looking back, Pierre Meyrat tersely observes: "To put it briefly, the DBS satellites of WARC '77 are too expensive and don't have enough channel capacity to attract viewers, and besides, they have too rigid a design to be able to adapt to commercial needs. We had a convincing marketing concept in the forefront with which we could win the programmers for ourselves."

Today Astra is so far ahead of the DBS satellites in the favor of viewers as well as programmers that, in the opinion of market experts like RTL-plus program director Dr. Helmut Thoma, D2-MAC has no chance in Europe based on pure laws of the marketplace: "D2-MAC is completely unnecessary. Astra is the broadcasting medium that will be most important in the future." The D2-MAC equipment manufacturing industry also contributed to the failure. To be sure, at the

time of the first Astra launch, the DBS satellites TV-Sat and TDF were technically in a position to transmit in D2-MAC, but inexpensive receivers for reception of the programs were still not on the market. Then consumers also decided differently than the bureaucrats and promoters of the new television standard, equipment manufacturers Philips and Thomson, had hoped. The demand for MAC equipment did not take off, while, on the other hand, the attractiveness of Luxemburg's PAL satellites continued to increase thanks to growing program variety and the large market for inexpensive Astra satellite receivers. With Astra, television enthusiasts can bring a considerably wider variety of programs—European, in contrast to the national "Footprints" of TV-Sat or TDF—into their homes than with the expensive MAC receivers.

Caption: Astra has won the European satellite competition. Consumers and programmers decided in favor of the Luxemburg satellite system. With its Medium Power Satellite technology, Astra beat the more powerful direct broadcast satellites.

Netherlands Increases Earth Observation Funding

92AN0090 Rijswijk POLYTECHNISCH WEEKBLAD
in Dutch 14 Nov 91 p 1

[Article by Gerard van Nifterik: "Netherlands: 70 Million per Year for Earth Observation"]

[Text] The Netherlands will appropriate 70 million guilders annually for ESA's new earth observation program. This will increase the national aerospace budget from 187 million guilders currently to 250 million guilders in 1995.

It was not an easy undertaking, but last week, the Netherlands finally determined the aerospace budget for the coming years. The new budget provides for substantially increased funding for the European earth observation program, mainly because The Hague apparently values environment and climate policy highly. An amount of 70 million guilders per year will now be made available, an increase of about 54 million guilders. This was announced in a letter from the Minister of Economic Affairs to the Chamber, explaining the Dutch aerospace budget for the coming 10 years. Apart from an increased budget for earth observation, our country endorses the continuation of other ESA programs, including the European space shuttle Hermes and the space laboratory Columbus. During the upcoming ministers' conference in Munich—from November 18 to 20—our country will ratify this officially. (The course of European aerospace for the coming years will be charted in Bavaria).

Participation

The budget increase brings the Dutch share in ESA's European space program to approximately 3.6 percent, considerably more than the current 2.2-percent ESA participation. The authorities hereby meet the wishes of industry, interest groups, and the larger ESA member

states, which have pleaded for increased aerospace funding for a long time. France even threatened to move the activities of the ESA research center ESTEC away from Noordwijk if the Dutch contribution to ESA was not increased. Although the threat was taken with a pinch of salt, it did show the European dissatisfaction with the national aerospace budget.

At first it did not look as if the authorities were indeed going to step up aerospace funding. During the interim budget audit last summer, it was even suggested that aerospace funding would have to be decreased. The fact that the efforts have been increased is due to the financial contributions of the "new" aerospace ministries: Environment, Development Aid, and Agriculture. These departments do not have their own space budget, but value the ESA earth observation program so highly that they proved to be willing—be it with some difficulty—to allocate funds for aerospace.

Ericsson, Saab Merge Aerospace Activities
92P60061 Stockholm NY TEKNIK in Swedish
7 Nov 91 p 5

[Text] Two of the three big Swedish space companies are going to combine into one company, Saab Ericsson Space.

The purpose is to obtain a stronger position on the European space market.

The company's main products will be computers and antenna systems for satellites.

At the end of the year Sweden will get a new space company. Then Saab Space and Ericsson Radar Electronics will combine into one company.

The background for the merger is that the European space market is changing. Even big companies have gone together to form still larger consortia. This has caused problems for the relatively small Swedish space companies.

"Now we are strengthening our position on the market and improving our competitiveness," says Rolf Rammarling of Saab Space.

In terms of products, there has been no competition between Saab's and Ericsson's space enterprises.

Saab's primary products are computers which have been delivered to a large number of European research and communication satellites.

For its part, Ericsson has furnished a number of European satellites with antenna systems.

Nevertheless, there has been an indirect competition between the companies.

For a Swedish firm to be present and compete for orders from the European Space Agency (ESA), the Swedish government must put money in ESA. The amount is now

about 400 million Swedish kronor per year. The basic rule in ESA is that about 60 percent of the Swedish money is returned in the form of orders for Swedish industry.

"To see that Swedish companies receive their share, ESA has been able to buy either computers from Saab or antennas and electronics from us," says Lars Marmgren of Ericsson Radar Electronics. Thus there has been competition.

Orders also could go to Volvo Flygmotor, which furnished, among other things, the combustion chamber for the Ariane launch vehicle.

In addition to the marketing advantages from the merger, there is also a strengthening of the technical basis for the future. Saab Ericsson Space will have access to the basic technology of both the Saab-Scania firm and Ericsson.

"Saab is strong, among other things, in materials technology in aviation, and we are very strong in microwave technology and telecommunications in general," says Lars Marmgren of Ericsson.

The new company will have about 360 employees and a turnover of 300 million Swedish kronor per year.

AUTOMOTIVE INDUSTRY

Peugeot Delivers Low-Maintenance, Recyclable Electric Car

92WS0057A Paris LE FIGARO in French
16 Oct 91 p 11

[Article by Philippe Loisel: "Electric Car Will Be 'Modulable'"]

[Text] The Peugeot S.A. [PSA] research group's latest creation is revolutionary. Bearing the Citroen stripes, the Citela, as its name implies, has been designed and built for the urban civilization. At present, it is only a prototype. Small, transformable, quiet, and above all, electric, its architectural design is innovative. Its "teardrop" line is very pure and attractive. Its interior provides multiple storage spaces and several possible organizations of the space as a whole.

Despite its small size (2.96 meters long by 1.55 meters wide), it accommodates, very comfortably, three grown-ups including the driver, and one child.

Its major innovation is its modular architecture. The Citela consists of a rolling platform structured around a central beam that stiffens it and secures it against frontal shocks. It is girded by a wide, protruding "bumper" that absorbs minor urban shocks. The sheet-steel subframe supports the power unit and the battery components. A 72-volt, 20-kilowatt electric motor propels the Citela's 790 kilograms of weight at a sustained maximum speed of 90 km/hr, with the capability of peaking at 110 km/hr

in bursts. Its cadmium-nickel batteries provide an operating range [without recharging] of 210 km at a constant speed of 40 km/hr, and of 110 km under city driving conditions. For an average trajectory—from home to office and back—in a large city, this amounts to five days of use without recharging.

To conserve energy, the driver is offered three driving modes that are controlled according to the length of the trip and the desired performance. In addition, an energy "retriever" partly recharges the batteries during deceleration. A system capable of quickly absorbing charging current enables the Citela to recover 2 km of range per minute of charge.

A Virtual Wardrobe

To conclude regarding the chassis, the Citela's 2.10-meter front wheelbase provides a high-performance turning circle radius of 4.30 meters. The rear drive wheels are brought close together, giving the car a somewhat unaesthetic "road-roller-like" rear end. Use of Michelin 155-65 R 14 MXL low-towrope-resistance tires results in a 30 percent gain in the running gear's effective pulling power, as compared with its performance using conventional tires.

While the supporting structure is one alone, the passenger compartment is interchangeable. Currently, the Citela wears three different suits: A 4-door sedan "suit," offering a complete compartment with abundant glazed area—including the roof; a convertible coupe runabout "suit" with surprisingly fluid lines; and a pickup "suit" designed for utilitarian use. These different "suits" are interchangeable in a matter of minutes, making it possible to offer a diversity of passenger compartments in various shapes and styles throughout the vehicle's life.

For, indeed, the Citela gives promise of an iron constitution: Its batteries and electric motor require very little maintenance. The useful life of the power unit components is around 1 million kilometers, and the batteries will not be "in danger" till near the end of a 10-year period of operation. To be sure, their current cost is likely to up the Citela's selling price. But within two or three years, the cost of these "energy traps" may be expected to drop considerably. Furthermore, the "full tank" of 220 volts [as published] is obviously cheaper (approximately 5 francs per 100 km) than super gasoline or even Diesel fuel.

All the Citela's parts are catalog items and are recyclable. This should bring a blush of pleasure to the cheeks of even the least tender-hearted of "greens"....

PSA thus joins the other automobile makers in a new approach to the problem of displacement in the city. Citela's concept—a clean, quiet car respectful of the environment—could change considerably the urban motorist's way of life in the years to come. It is possible, in fact, to envision, alongside the family-outing car designed for interurban trips, the coexistence of a Citela exclusively for intra-urban use. The "sexist" pair—the

mini for the Mrs, and the man-of-the-family car—would thus be advantageously replaced by the urban agglomerations car and the open spaces car.... And one day, the car will bring the countryside to the city.

Peugeot's Use of Just-In-Time Manufacturing Described

92WS0057B Paris *LE FIGARO (LE FIG-ECO SUPPLEMENT)* in French 15 Oct 91 p 11

[Article by Y. B.: "Suppliers Under Pressure"; first paragraph is *LE FIGARO (LE FIG-ECO SUPPLEMENT)* introduction]

[Text] Mulhouse—Just 150 minutes after receiving an order, the STMP [Plastic Materials Transformation Company] delivers the fuel tanks of the "106" to Peugeot's assembly lines. The automobile maker can be expected to impose the system progressively on its principal suppliers.

Peugeot-Mulhouse's 273 subcontractors and their 3,500 or so employees work at the pace set by the automobile maker, adapting theirs to the latter's needs, as does the STMP, a subsidiary of Solvay, with head office in Laval. Its Alsace unit has grown by leaps and bounds as STMP's automobile division, in which capacity its role has had a direct bearing on the bringing out of the "106."

From a total of some 10 employees in 1981, when the STMP, the leading European maker of automobile fuel tanks, took over an old textile company, its staff has grown to its present total of 160 persons. Given the rapid ascent of Peugeot's latest model in the marketplace, STMP's staff is expected to increase to 200, for a revenue of 200 million francs [Fr], "says Francois Lepoivre, who heads STMP-Mulhouse.

But in a region where Switzerland beckons to several thousand border residents, recruiting is a thorny problem. And retaining qualified personnel becomes a pressurized challenge.

STMP-Mulhouse has both enlarged its gamut of product lines and reorganized its production so as to respond to the requirements of the automobile maker. For the "106," in addition to its fuel tanks, the unit supplies also the car's shock absorbers and some of its piping.

An Order Every Two Minutes

The STMP's major innovation has been the putting in place of a "synchronized flat-flow" system of production—synchronized, that is, with Peugeot's "106" assembly lines, and involving no stocking-up whatever by the car maker or by the subcontractor. The STMP has contracted to deliver within two and one-half hours all orders, transmitted at the rate of one every two minutes by computer, concerning 14 different models. "Let us be modest," Francois Lepoivre acknowledges. "We have done nothing other than adopt the Japanese model." Peugeot expects its new assembly lines to deliver

between 1,300 and 1,500 cars [as published] when its "106" production lines attain cruising speed.

This choice by STMP has entailed a complete restructuring of its services and the instituting of a proprietary logistical procedure based on the use of computer-assisted management techniques. But most importantly, a flat flow necessitates "flawless production quality." And this, in turn, entails one imperative: The need to train and motivate the personnel as a whole to deliver on their commitments to schedules and timetables. To deliver on this contract with Peugeot, STMP has, for several years, been devoting 10 percent of its total payroll cost to the training of its employees.

Around the beginning of September, as an offshoot of these outlays the Mulhouse-based plant earned the "A" awarded by the U. S.-based Bill Belt consulting firm to firms exhibiting very advanced use of computer-aided production techniques. In France, only 19 other industries have earned this prestigious award.

France: Total Factory Automation, Robot-Human Role Reconsidered

92WS0088A Paris INDUSTRIES ET TECHNIQUES in French 9 Sep 91 pp 34-40

[Article by Michel Alberganti: "Humans Returning the Robot to Its Place"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] The automobile industry has lost its faith in frenzied automation. The robot has lost some of its prestige and the human is regaining it. The SMAE [Automobile Mechanical Company of the East], which manufactures motors in large-scale production quantities, has just installed a new production line that symbolizes this turnabout in exemplary fashion. The principles it embodies prefigure a revolution in the art of producing.

"The industry has gone too far in automation...." Voiced by Vincent Spataro, head of the new engine-production line being put in service in the SMAE workshop, the verdict is unappealable. Today, criticism of "100-percent robotized" installations is spreading throughout the automobile industry. The dream of the 1980's is going up in smoke. No, the replacement of all humans with robots is not on tomorrow's agenda. No, all-out automation is not synonymous with profitability. No, quality and productivity are not the feats of a triumphant high technology alone. Even though the leaders of the French automobile industry hardly ever allude to it, this fact of failure heralds the return in force of the being it was sought at all cost to evict from the workshop: the human being.

At Tremery, the SMAE plant that makes the XU gasoline engines for the Peugeot and Citroen automobile lines stands as a valid symbol. Over the past 10 years, it has gone through all the phases of the automation crescendo, attaining its apogee in 1986 with its XU2 workshop.

Today, it is shifting lanes toward a more judicious use of automation. Its new assembly plant, XU3, takes scrupulously into account the lessons of the past. Robotized systems find themselves being replaced by operators for the assembly of certain parts. The number of automated workstations has been halved. The change is all the more significant in that, for SMAE's previous installation, the XU2, a single rule had the force of law: Automate everything that can be automated. And do it in a minimum of space; machines do not have to circulate.... All the hardware—robots, automatic machines, programmable automats, numerical command equipment, integrated electromagnetic memory, in sum, the works—went into its makeup. In profusion. Result: The planned assembly rate of 1,500 motors a day took 18 months to achieve, instead of the planned six months, with the XU2 workshop taking the brunt of the quasi-totality of design errors deriving from the "full automation" concept (see Box 1). All with one factor in common: Underevaluation of the human role.

To the question as to what mistaken concept could have underlain the resounding failure of "full automation," Denis Fourchon, the project manager and head of gasoline motor assembly methods, provides a categorical response, pointing out the philosophy that governed the design of the new workshop: "We have inverted the XU2 priorities: Quality has replaced productivity." A brief sentence loaded with consequences. And by way of follow-up: "Our initial investment in the XU3 workshop is aimed essentially at ensuring the desired level of quality. This does not mean that we will neglect productivity. But we have opted for according primacy to investment in automated systems that ensure quality. We are banking on the ability of the shop itself to improve its productivity, on its own, little by little. Good ideas always suggest themselves after the start-up of service." The fact is that the efficiency goal set for XU3 is higher than any ever attained by XU2.

Adoption of the principle of gradual, small improvements—an approach used by the Japanese and termed by them "Kaisen"—represents a profound change of mentality. The vitality of the workshop—that is, of the persons who are its prime movers—is resolutely given prime billing. This concept runs altogether counter to the "total-automation" mentality. No longer is the methods bureau the place where the engineers plan, in toto, the characteristics of the workshop that is to be designed. When this is done, the set of solutions adopted is rigid, and it is very difficult to introduce the slightest modification. In contrast, the approach that prevailed for the XU3 consists of a definitive sharing of tasks. The methods bureau prepares a favorable terrain on which the workshop personnel's creativity and skill can express themselves. It will be up to them to "finalize" the performance objectives. Instead of merely performing a fixed task, the personnel will enrich it. They will no longer serve the machines but instead will operate them as the actual "tools" they are.

SMAE: The New Motor Assembly Line Philosophy

Production Lines	XU2	XU3
Startup Date	February 1986	September 1991
Design time	4 years	2 years
Output capacity	1,500 motors/day	1,200 motors/day
Families of motors	4	3
Investment	Fr410 million	Fr350 million
Floor areas	10,700 sq m	14,000 sq m
Number of automated stations	80	35
Manual operations time	56 min	70 min
Cycle times	30 sec	40 sec
Number of persons	224	210
Number of motors per person	6.7	5.7
Efficiency*	0.7	0.8

* Reference is to efficiency objectives termed "synthetic objectives" representing the ratio between the number of good pieces actually produced and the number of good pieces theoretically producible.

The differences in characteristics between SMAE's XU2 and XU3 production lines illustrate the change in concept. Particularly notable is the drop in the number of automated workstations, and a reduction in the number of motors produced per person. On the other hand, the efficiency of the production line should, in due time, be higher.

The set of options adopted in the design of the XU3 has resulted in an optimized sharing of tasks between human and machine. Two concurrent changes characterize the automated workstations. Their number has been reduced—from 80 to 35—and their nature has been changed: "We have generalized the automation of operations directly connected with quality," says Denis Fourchon. Several stations of this type, manual in XU2, have been automated in XU3, e.g., quality test stations for checking seals, gaskets, etc for leakage, and for checking compression ratios and operating temperatures, as well as a station for purging the engine-block of foreign matter.

New Human Presence on Assembly Line

"On the other hand, we have de-automated the distribution systems almost entirely." Denis Fourchon explains that the automation of operations that feed components—such as screws, washers, etc—and parts—such as water pumps, dashboards, steering wheels, etc—to the machines is a causative factor in production downtime. Automation of the transport of parts has long been considered one of the prerequisites for automation of assembly operations. In Denis Fourchon's view, return to the manual mode is justified by "the difficulties of refining the automatic mode, and by the fact that automation of these operations is at the origin of many failures that seriously compromise the viability of the investment." He adds that such systems limit the plant's flexibility: "Automatic feed mechanisms do not accept modifications, no matter how slight, to the geometry of the pieces they handle." Given these drawbacks, a redistribution of tasks is clearly necessary. The manipulation of parts and assembly of components have reverted to the manual mode, while the final operation—bolting, for example—is performed by the machine.

The advantage derived from introducing this new human presence on the assembly line is not limited to the elimination of feeding problems. Although the machine makes for quality, owing to its regularity and its built-in capability for self-testing the quality of its own work, the operator who manipulates the pieces brings a priceless complement to the task. A mere glance on his or her part will detect, for example, a scratch on the gasket face of a cylinder head. SMAE takes systematic advantage of this capability. In XU3, the operators are given the responsibility of "coding" the faults they observe. This coding is done in the simplest possible manner: The operators are given a list which assigns a number to each problem.

The operator then decides on one of two options: Either to repair the defect, if he or she has the means, or to divert the engine to a retouching point before it reaches the assembly machine. Denis Fourchon points out that the information pertaining to these cases is diligently preserved. "The operator records the existence of the fault on the electromagnetic memory that accompanies each motor the entire length of the assembly line process. If the operator has repaired the defect, the information is retrieved at the conclusion of assembly operations and stored in the plant's central computer (a VAX). At the retouching points, the retouchers enhance the plant's 'faults' data base." This method offers two advantages: First, the faults are detected and eliminated the earliest on within the assembly line; and second, their existence is recorded and the data processing that it undergoes furnishes useful information regarding dysfunctions within the plant.

In the XU3 workshop, the assemblers thus perform tasks of assemblage, detection and identification of faults, and certain repairs. To facilitate their work, SMAE has gone

all out to simplify the manual assembly stations. "It appeared necessary to us to standardize as much as possible everything involving relations between the human being and the machine, for the assemblers as well as for the materials-handling teams." Denis Fourchon points out that the XU2 workshop has four different types of machine command consoles. In the XU3, the assemblers find themselves operating one and the same type of console regardless of which assembly line machine is involved. This has not been the result of a standardization among the suppliers (Num, SMC, and Siemens), but of the development and introduction of a customized console between the user and the numerical commands. The same approach has been used in materials handling. The architecture of the machine command programs has been standardized.

The equipment is simpler and more adapted to needs and will therefore be more easily and rapidly mastered by the shop personnel. And the more so in that special attention has been given to the training of the personnel. The machine operators were recruited earlier on than is customary. These production workers will be responsible for tracking the operation and maintenance of a group of machines and will also be capable of operating a workstation. They have participated in the development of the production line and have visited the suppliers of the machines.

In Search of a New Machine-Human Balance

The same is true of the materials-handling technicians. Nine months before the putting in service of the shop, these technicians began training periods with the suppliers, so as to familiarize themselves with the machines' programs.

SMAE's experience at Tremery with the XU3 workshop reflects in all its aspects a dual concern: Simplify the machines, think of the humans. The very substantial increase in the workshop's floor area "makes for greater comfort and freedom of movement of the operators and for easier visual supervision by those responsible for an assembly zone." Denis Fourchon stresses the need for one and the same person to be able to "take in an entire process—for example, that of assembling the connecting-rod array—at a glance." This ease of visual supervision is incompatible with the breaks in the flow of production that characterize XU2. "XU2 was not designed in the same manner as XU3."

If the Tremery experiment yields the expected results—and it will be a year from now before judgement can be rendered—it will provide one of the first concrete examples of a revolutionary concept of automation. The contribution of machines to mass production on a large scale is not being disavowed. On the other hand, the emphasis is now on the search for a new balance between machine and human. Japan—or at least its most efficient firms—long ago found this balance. It is unquestionably and to a very great extent indeed at the origin of their successes. To be convinced of this, suffice it to note the

number of persons in Japanese plants who are assigned to tasks not directly connected with production but all connected with quality.

But with some very rare exceptions, such as the automobile industry, has European industry as a whole matured sufficiently today to set forth on this road? There is reason to doubt that it has. The validity of the total-automation concept was universally agreed during the 1980's, when the West believed that every Japanese had a hidden robot on his person. Who did not dream of an industry whose plants would be totally staffed by machines in place of human beings? Who did not believe that technology would resolve all problems? Who would have bet, 10 years ago, on a return of humans to displace the robots?

[Box 1, p 39]

In the Jungle of Automated Devices, a Breakdown Is Unpardonable

The experiment on which the Tremery plant has set forth with its new motor-assembly installation is based on the lessons learned in its operation of the previous workshop, the XU2. The shortcomings observed stemmed essentially from two characteristics: First, the explosive marriage between complexity and compactness. And second, the diversity of the technologies employed.

The first of these began wreaking its ravages in the very design phase: No less than four years of design studies! A timeframe comparable to that needed by the Japanese to design and put into production a new model of car. Once the design studies were completed, the system had to be installed and made operative. The cost of its complexity: A year's delay in putting it in service, and an intensification of the training of its personnel. As for the compactness of the installations, it tallies perfectly with the logic of the workerless-plant myth. The machines were to do all the work. It seemed useless to waste valuable space on easy accesses to the machines for trouble-shooting and maintenance crews. By definition, the need for their services would be extremely rare. Suddenly, the jungle of automated devices, robots, manipulators, conveyors, and other special machines found itself installed "on a pocket handkerchief," as Vincent Spataro puts it. A disastrous error. The reality is something entirely different. Complexity is a multiplier of malfunctions, and compactness calling for acrobatics lengthens repair times. The result: A downtime rate that far exceeds design expectations. The XU2's throughput has never attained design objectives, and today, after five years of operation, it is still considered "bad" by comparison with that of other far less automated Tremery plants.

In Vincent Spataro's view, the second of the aforementioned characteristics is not the least by far: "Total automation entailed an extreme diversity of installed equipment, hence a multiplicity of training for the

personnel and a lengthening of troubleshooting and repair times on machines." This heterogeneity of the technologies presented by the machines can be ascribed to the difficulty of automating certain particularly complex operations. Total automation of an assembly operation necessarily involves the identifying of pieces, locating them in space, orienting them, seizing them by means of a suitable gripper, and then positioning them very precisely. Diversity is inescapable, but it could be limited if, during the designing of the shop (and of the pieces themselves), the notion of the comfort hence efficiency of the users were allowed to enter the process as a major criterion [as published]. Instead, it is frequently neglected by both the design studies staff and the production methods bureaus.

[Box 2, p 40]

Automobile Assembly: Quality of the Personnel Is Paramount

The putting of automation at issue again in the automobile industry is a difficult notion to address. Despite the fact, of which there can be no doubt, that some automobile assembly plants have been the scene of setbacks owing to over-automation, none offers as vivid a show of it as does Tremery. Particularly as regards final assembly.

Each of the French automobile makers espouses a different philosophy. The champion in all categories is Citroen. At Rennes, the installation put in service for the XM in 1989 is without equal. The coefficient of automation of final assembly tasks there attains 33 percent! This means that, of the 1,200 minutes of work involved in this operation, only 800 are manual. Comparison with the Japanese speaks volumes. In Honda's very latest assembly plant at Suzuka, automation of its final assembly line has not exceeded a level of 25 percent. Citroen is not re-assessing this strategy. At least, not at Rennes, even though at Aulnay, for the ZX, the mounting of the wheels has become a manual operation

again. Didier Simon, head of investments in assembly facilities at Rennes, summarizes the situation: "With the final assembly of the XM, we have reached a point of maximum automation. It is not at all certain that we shall go much beyond that point, at least not within the foreseeable future." The bottom line is excellent, if one is to believe the engineer: "The installation's reliability is good and the training of its personnel is complete." Then why not exploit the Rennes experience at other PSA [Peugeot Corporation] sites? "Robotics is not an innate science..." says Didier Simon. Others cite the "quality" of the personnel and refer in particular to the percentage of immigrant workers as one of the factors that limit the chances of success of a sophisticated automation. This view is referenced to the sociological characteristics of the population concerned. Citroen chose the Rennes site after a study of Brittany's population, which is very attached to its home region and highly motivated in responding to the challenges of the XM plant. The percentage of immigrants among the Rennes plant personnel is zero. Didier Simon adds: "In the case of the XM, we built on vacant terrain and hired the necessary personnel. It is much more difficult to automate an existing plant that continues to produce. This, however, is what we will be trying to do for the Citroen car of the future."

Rennes continues, but Peugeot has taken its foot off the automation accelerator. The final assembly of the future 106, at Mulhouse, will be decidedly less automated than that of the 605 despite much higher output rates. Peugeot's reasoning approaches Citroen's. The 106's assembly lines will be versatile. They will continue assembling the 205. "If we had started from scratch, we would have attained the same level of automation as at Sochaux for the 605," he asserts.

Automation thus has yet to reveal definitively the extent to which it surpasses the point of being trivial. One thing alone is clear: Among the prerequisites for its success, the quality of the personnel, from the standpoints of both design and operation, ranks uppermost.

Automation in French Automobile Industry

Makers	Models	Model Year	Main Assembly Plant	Cars/Day (Capacity)	Automation			
					Welding (Percent)	Final Assembly		
						Dashboard	Windshield	Wheels
Renault	R19	1988	Douai	1,350	98.5	Yes	No	No
Citroen	XM	1989	Rennes	460	100	Yes	Yes	Yes
Peugeot	605	1990	Sochaux	500	100	Yes	Yes	No
Renault	Clio	1990	Flins	1,550	99	Yes	No	No
Citroen	ZX	1991	Aulnay	700	100	Yes	Yes	No
Peugeot	106	1991	Mulhouse	1,500*	100	No	No	No

* Combined 205 and 106 production capacity

The trend toward increased automation of assembly operations is waning for models such as the ZX and especially the 106. But total robotization of welding is not at issue.

BIOTECHNOLOGY

Germany, Switzerland To Produce Biosensors

92MI0069 Stuttgart LASER UND
OPTOELEKTRONIK in German Oct 91 p 17

[Text] Under its Biotechnology 2000 funding program, the BMFT [Federal Ministry of Research and Technology] is supporting the joint project on "immune sensors for the gas phase." Under the leadership of Draegerwerke in Luebeck, model sensors for measuring air impurities in the workplace and the environment will be developed jointly with the University of Luebeck and the Borstel Research Institute. A pesticide for plants and a bacterium have been selected as the model test substances. The new sensors will use the same reaction principle that is also used in clinical tests: The antigen-antibody reaction, whereby the pollutant to be measured, the antigen, is recognized by the reagent, the antibody.

The target is sensitivity in the ppb [part per billion] range, which means that one molecule of the pollutant is detected in one billion other molecules (1:1,000,000,000). The maximum sensitivity that can be achieved depends on the kind of reaction. Enhancing this reaction with a second biological reaction, an enzyme detection reaction, gives additional sensitivity.

The enzyme reaction must be carried out in such a way that pigmentation increases as the quantity of pollutant rises, and the pollutant concentration can be established with the aid of a color comparison strip. This makes for cheap on-site testing. Successful development of the two planned model sensors will represent an important step in the direction of widespread use of biological sensors to detect environmental pollutants.

Germany: Recent Biotechnology Developments Reviewed

92MI0074 Bonn DIE WELT in German 28 Oct 91 p 23

[Article by Rolf Latusseck: "Plastic From Plants?"]

[Text] Despite the remarkable developments achieved in biotechnology, there is still a long way to go to being able to synthesize everything in the test tube. Though suppliers of technical laboratory equipment continued to form the majority of the 400-plus exhibitors at this year's Biotechnica fair in Hannover, microorganisms nevertheless remain a major factor as the "workhorses" of biotechnology.

Their abilities to compose or degrade even the most unusual substances are almost unlimited, and to do so

they do not even require manipulation by genetic engineering. Alexander Steinbuechel, a microbiologist at the University of Goettingen, is working on bacteria that store "synthetic" substances as food reserves.

The rod-shaped bacterium *alcaligenes* synthesizes a polyester from carbohydrates and stores it in its cellular body in the form of minute globules. "*Alcaligenes* does this when there is still sufficient food containing carbon available, but other nutrients are in short supply," explained Steinbuechel in Hannover. This polyester, composed of what are known as hydroxy fatty acids, can easily be extracted and processed as a raw material.

It is used to produce "plastic" bottles or other packaging, and even medical supplies such as sutures, gauze, and reabsorbable bone plates. The great advantage of these natural polymers is their derivation from regenerative raw materials and their rapid biological degradability, measured in just a matter of months after the material is covered in soil.

As sugar is one of the available sources of carbon, work is currently under way on isolating from *alcaligenes* the hereditary information required for producing polyester and inserting it into sugar beet. The beet would then be used instead of sugar to provide a direct supply to the desired polyester. However, this goal can certainly not be achieved in the near future, as it requires the transfer of not just one, but several genes.

In principle, however, it is not impossible to transform higher plants into "bioreactors." Human genes for immunoglobulin and serum albumin are being inserted into tobacco and potato plants, which then also produce these foreign proteins, though only in small quantities so far. "It is amazing just how much plants will put up with," commented Professor Lothar Willmitzer of the Institute of Gene Biology Research in Berlin, on such experiments.

It is not always necessary, however, to give the plants totally new properties. Returning to the potato, the gene of the enzyme that catalyzes the final stage in starch synthesis has been successfully paralyzed; the potato then stores sugar instead of starch in its nodules.

Willmitzer sees a great future for such "industrially viable" plants: As living bioreactors out in the fields, they produce large quantities of specific raw materials at low prices—raw materials used by the chemical industry to manufacture drugs, building materials, and cosmetics.

Over 80 percent of chemical base materials currently derive from petroleum and natural gas, only 10 percent deriving from regenerative sources. Their limited availability and the overproduction of agricultural products in the developed world suggest however that it makes sense to place greater emphasis on raw materials of vegetable origin.

Professor Gerhard Wenzel of the Federal Biological Agency for Agriculture and Forestry favors the old utility plants cultivated for centuries in central Europe as sources of raw materials: barley is particularly suited to

industrial use owing to its excellent adaptation to the soil and climate in Germany. Starch and cellulose are already being used to produce alkali polysaccharides, which can be added to detergents as dirt solvents (tensides) of good biological degradability.

The range on offer at Biotechnica did not only comprise products of microbiological processes, however: Reprocessed blood serum as a nutrient solution for bacterial or tissue cultures, growth regulators for cell reproduction, and highly purified biocatalysts (enzymes) for analysis and synthesis were also sought after.

At present, the application of the polymerase chain reaction [PCR] is a front runner in laboratories. The PCR method is the natural choice when it comes to reproducing genotypes from archaeological remains, finding new genes, or multiplying DNA from blood traces for identification purposes. This process uses the basic genetic building block, the nucleotide, which are linked to form new DNA molecules. The range of existing applications for the polymerase chain reaction is constantly being extended, and demand for nucleotides is high; they are therefore supplied by specialist producers who extract their products from biological material.

A Norwegian firm based in Tromsø, for example, reprocesses waste from fish, extracting from the innards, which were previously discarded, the gonads of male fish, from which the genotype is isolated. After further processing, the tissue is finally cleaned and separated until saleable end products are obtained: the four nucleotides forming the genetic material.

They are purchased by molecular biology laboratories, which use these four basic components to reconstruct DNA. Thus DNA is painstakingly broken up at one location to be carefully reassembled elsewhere, though in a different nucleotide sequence.

Germany: New Laender Integrated in Biotech R&D Association

92MI0120 Graefelfing BIOENGINEERING FORSCHUNG + PRAXIS in German Oct 91 p 12

[Text] Greifswald University too has now joined a joint biotechnology project. Another step has thus been taken towards involving scientists from the new federal laender in an existing BMFT [Federal Ministry of Research and Technology] joint project in which the Universities of Hamburg and Bielefeld, the Hamburg-Harburg College of Technology, and the Biotechnology Research Society (GBF) are already participating. In concrete terms, it addresses the biological degrading of highly toxic dioxin compounds.

The goal of the new subproject, which incorporates several teams from the University of Greifswald, is to extend the biological degrading potential for dioxin-containing compounds, primarily by using yeast and fungi. Work in the old federal laender has previously concentrated on the bacterial degradation of dioxins. By

widening the range of biological systems in this way, it should become possible to remove a pollutant under widely varying ecological conditions. Thus optimizing degradation at polluted sites. The objective is to select the strains that have the best degradation properties.

The new subproject is being funded by the BMFT with 400,000 German marks [DM] (total funding amounts to DM4.5 million). It represents concrete addition to the previous joint project and a further step towards overcoming current difficulties in the new federal laender. As dioxin pollution presents a large problem there, the participation of the Greifswald teams has great relevance and practical significance.

During the project, young scientists from Greifswald will learn modern, highly effective methods of biochemical analysis at partner facilities in other laender and apply them to answer important questions while working on their assignments. These up-and-coming scientists will therefore also serve as effective disseminators of the most modern methods and latest information while teaching students at their home universities.

Germany: Neurotransistors Developed at Ulm University

92MI0120 Bonn DIE WELT in German 13 Nov 91 p 27

[Article by Rolf H. Latussek: "Harmony Between Nerve and Transistor"]

[Text] Two "interfaces" are needed to enable human and computer to communicate: hands and keyboard provide for the flow of information towards the machine, while the VDU screen and the eyes provide for the flow in the opposite direction.

However, the actual processing of information, both in the computer and in the human brain, follows similar physical principles: the machine's circuits exchange electrical signals, while the brain's nerve cells use such signals to relay messages.

Therefore, it should in theory be possible to connect up brain and computer far more directly, without the roundabout routes described above: the required interface could consist of a nerve cell and a transistor. A "neuro-transistor" of this very kind has recently been built by Peter Fromherz and his team at the Institute for Biophysics of the University of Ulm.

The scientists isolated nerve cells from medical leeches and kept them alive in a nutrient solution. Using a peptide (polylysine), one of these cells was then "stuck" to the gate input of a field effect transistor. If this cell is then appropriately stimulated, an electrical signal runs through the entire cellular membrane.

This signal operates on the gate as a gate voltage, which can be measured as an alteration in the emitter-to-collector current. The nerve cell/silicon oxide layer contact surface at the gate functions as a "biological-technical synapse" enabling a data bit to be input from a biological into a technical system.

The electrical signal running through the cellular membrane is a phenomenon occurring in the same way in all animal nerve cells, described by biologists as "action potential." Starting from the cellular body, a message always runs as action potential via the long extensions (axones) of a nerve cell towards the destination cell for which the message is intended.

Owing to this universal process, it should be possible to connect any nerve cell to a transistor, and the number of such contacts could also be, theoretically at least, of any size. Entire networks in the form of "neurochips" will not however be possible for some time to come.

"This will not come about in such a highly developed form in a matter of a few months or years," concedes Professor Fromherz, "but will be a long way in the future, in view of the vast distances between our successes in the laboratory and related technical applications." Biological-technical synapses could be particularly significant for the development of new biosensors.

These sensors are based on biological processes which enable the most minute quantities of substances to be measured. These are mainly biocatalysts (enzymes) which alter the substance concerned in such a way as to cause a detectable reaction product. For example, some biosensors for measuring the blood's alcohol content alter the alcohol enzymatically in such a way as to cause a product which can be measured using a weak electrical current. Such complicated methods are no longer needed with biological-technical synapses.

Only recently, American researchers published work describing how the sense cells in the olfactory mucous membrane of vertebrates have at least hundreds, if not thousands, of different receptors. Such a sense cell could be connected on the biological side of the synapse to the nerve cell—in exactly the same way as achieved by nature in all animal sense cells.

The sense cell concerned, receiving specific olfactory, optical, or other stimuli, then relays its information via the nerve cell and the transistor to be further processed in a computer. Professor Fromherz and his team are currently working on making nerve cells grow in a specific, predetermined direction.

They are once again using leeches; in addition a protein, known as laminin, located between the cells of the nervous system, is extracted, which has a growth-stimulating effect on the preserved nerve cells. The laminin is applied as a thin layer to a surface, for example a small glass slide. If nerve cells are now stuck to

it and the whole is immersed in a nutrient solution, new axones grow out of the cells, branching out irregularly like trees.

If, however, the laminin layer is previously irradiated with ultraviolet light, the protein loses its biological activity, and the nerve cells cease to grow on the irradiated layer. As with technical etching processes, this light sensitivity can be used to produce predetermined tracks on the layer, by placing for example a microscopically thin lattice on the protein layer prior to irradiation and afterwards removing it.

The axones which sprout on the thus-treated laminin layer move, in precise straight lines and without branching, along the nonirradiated intact tracks, branching out regularly only at the lattice intersections. Although these experiments in Ulm were originally intended only to improve investigations into action potential, it is perhaps possible to connect nerve and sense cells in this way in a predetermined network.

However, no investigations have yet been made into whether two cells can establish contact on meeting, so that an exchange of information takes place between them. There remain other unsolved problems, too: one of the already anticipated difficulties will be that of keeping the cells alive sufficiently long; being biological systems, to obtain energy they have to maintain their vital metabolism, for which nutrients must be continually supplied and waste removed. It is not yet possible to foresee when, and indeed whether, such problems will be resolved.

Bacteriorhodopsin As Optical Storage Medium Discussed

*92WS0047 Duesseldorf VDI NACHRICHTEN
in German 20 Sep 91 p 18*

[Article by Ludwig Kuerten: "Molecular Electronics Modelled on Nature: The Search For the 'Green Chip'"]

[Text] Nature has devised molecules and molecular systems, the performance of which far surpasses comparable technical systems. One example is photosynthesis: the conversion of sunlight into high-energy chemical compounds. Green plants and some algae capture light particles (photons) and use them to turn carbon dioxide and water into the "building blocks of life:" carbohydrates, fats, and nucleic acids.

Natural systems are not only one hundred times smaller than solar cells, they are much more efficient. Scientists have calculated that when dextrose is synthesized via photosynthesis, approximately 36 percent of the light energy is stored in chemical form.

Scientists have not yet succeeded in explaining all the chemical reactions and physical processes that occur in higher plants during photosynthesis. They have, however, discovered bio-molecules which can be used for technical purposes. One of these is bacteriorhodopsin

(BR), a molecule used by the halophilic halobacterium halobium to produce energy.

The structure and function of this pigment, which is related to the visual pigment in the human retina, has been largely explained. BR is contained in a special part of the bacterial membrane, where it acts as a sort of light-activated pump. When a pigment molecule absorbs a photon, the molecule goes through a cycle, during which its chemical or physical state changes several times. This is called the photic cycle. As a result of each cycle, a proton, i.e., a positively charged particle, is transported from the inside to the outside of the membrane.

The pumping action by many BR molecules causes a drop in the number of charged particles in the membrane, creating an electrical potential. This is used by the cell to produce the energy-rich compound adenosinetriphosphate (ATP). ATP can be used anywhere in the organism as an energy source for reactions. Thus, the bacteria can convert sunlight into storable chemical energy that can be used later for metabolism.

Professor Christoph Braeuchle and Dr. Norbert Hampp (University of Munich Institute of Physical Chemistry) together with Professor Dieter Oesterhelt of the Max-Planck Institute of Biochemistry (Martinsried) have discovered a way to use BR as an optical storage medium for information.

The researchers sealed BR molecules, which can now be "cultivated" in any quantity, in a plastic sheet. Using a laser, it is possible to shine light through the pigment film, enabling the scientists to switch back and forth between certain phases of the photic cycle.

The duration of the individual phases within the cycle is temperature-dependent. For example, state "M" is thermally stable below 40° Celsius (C); at this temperature it is frozen, so to speak. Only when exposed to laser light at a wavelength of 312 nanometers (nm) does the phase switch to ground level state B, and only when exposed to laser light at 570 nm does it switch back to state M. Thus, the BR film becomes a storage medium of extremely high density, as each square centimeter of film can theoretically hold 100 million information units (bits).

This packing density can be increased by ten thousand fold if the third dimension is also utilized.

Until now, however, the BR medium had one drawback: At room temperature, the individual phases of the cycle have a very short lifetime. The researchers have now succeeded in using genetic engineering to modify the BR molecule in such a way as to give the "M" phase a maximum lifetime of approximately 14 seconds. Further genetic engineering modifications are expected to enable scientists to further increase this lifetime.

The existing BR system can already be used to process optical information. The Munich researchers have constructed a laser system designed around a BR film. The system can be utilized to increase visual contrasts, in other words, to emphasize the lines and edges of structures in order to more rapidly identify them.

The BR system can also be used for optical pattern recognition, i.e., to filter out a particular pattern from the background of a picture. Another application for the BR system is associative optical memory, whereby "similar" rather than "identical" structures are recognized and pulled out from a complex background. Finally, optical-based neural networks are also possible.

The next step in this research will be to develop BR mutations that have all the advantages of the natural pigment, but have individual phases with much longer lifetimes.

The advantages of the system are obvious. After each photic cycle, the bacteriorhodopsin reverts to the ground level state, making it fully "reversible." Consequently, up to a million cycles can be executed without the system "wearing out." Furthermore, it is extremely light sensitive, which means that its particle yield is very high. The material is extremely resistant to chemical decomposition; it is available in unlimited quantities; and it can easily be embedded in polymer films.

There are other photosynthetic molecules in nature. Those in purple bacteria have been particularly well researched. In these bacteria, the photosynthesis system encompasses several separate molecular groups. The so-called antennas, which consist of various blue, green, and red pigments, capture photons from sunlight and hand them down the line to the "reaction center" embedded in the bacterial membrane.

This center consists of a chain of several molecules, beginning with a double chlorophyll molecule. Excited by the photons, this molecule emits a (negative) electron, thereby becoming positively charged itself. The electron is led along the molecular chain to the inside of the membrane, where there is a quinone molecule.

The quinone splits hydrogen and adds a (positive) proton. It then moves back through the membrane and deposits the proton at the exterior of the membrane, at the same time returning the electron to the chlorophyll, which is then ready to begin a new cycle. Thus, in a process similar to that which occurs in the halobacteria, an electrical potential is created which is used by a separate molecular system to synthesize the cellular fuel ATP.

Researchers at the Technical University of Munich at Maria-Elisabeth Michel-Beyerle have discovered that the electrical charge is passed along the chain from molecule to molecule via very complex processes, in which quantum physics effects play a decisive role.

It is theoretically possible to construct artificial molecular chains in which electrical charges are separated and electrons are "passed on." Some synthetic molecules have already been developed in which charges are transported, or "passed on," from one point to another within the molecule.

A molecule synthesized by researchers at Arizona State University comes very close to having the properties of the chlorophyll molecule. It is composed of two porphyrin rings along with carotene, and quinone. When a photon strikes the molecule, an electron is freed in the porphyrin rings. This electron then "jumps" to the end of the long-chain molecule.

As a result, the molecule has a positive charge on one side and a negative charge on the other. The charges are only separated for approximately 55 thousandths of a second. This time could be used to transmit the electron to a second molecule, if, for example, both ends of the molecule were embedded in films composed of a conductive material. In this manner, the molecule could be used to produce an electrical current. However, this sort of technical application is still far in the future.

Japanese researchers are currently experimenting with synthetic organic molecules which can be used for optical storage. Derivatives of the so-called azobenzenes, fulgides, and spiropyranes have been synthesized for this purpose. They can be excited by ultraviolet light in various wavelengths. Several of these compounds, selectively excitable by light in very exact wavelengths, could be placed on top of one another in extremely thin layers. This would result in a three-dimensional data storage unit, the individual layers of which would be controlled by different frequencies.

Scientists have long been aware of organic molecules that conduct electrical current. Such molecules are polymers, or networked molecules. They are "doped" with chemicals which emit (donors) or accept (acceptors) electrons. The additional charged particles make the polymers conductive, making them "one-dimensional metals," so to speak. Such organic materials now have conductive capacities comparable to those of doped silicon.

In contrast to the "doping" of a silicon semiconductor, where silicon atoms are replaced by atoms having either more or fewer electrons, the foreign atoms in a conductive polymer are only mixed in. The "record" is held by a polyacetylene developed a few years ago by Baden Anilin and Soda Factory (BASF): Its conductive capacity was approximately one third that of copper.

It has long been thought that these extremely light conductive materials could have a technical application, as batteries or chemical sensors, for example. Organic materials have important advantages over conventional, non-organic conductors: They are much smaller, can be used to construct three-dimensional switches, and can be packed very densely.

However, they also have one serious disadvantage. They are not durable enough, as their structure changes relatively rapidly. Experts therefore predict that electrically conductive synthetics will only find technical application if their durability is increased significantly.

One obvious source of lattice defects is the point where the polymer comes in contact with nonorganic materials, such as metal electrodes. This was demonstrated, for example, by the light emitting diodes (LED's) that British researchers manufactured from organic materials. The LED's consisted of thin layers of polyparaphenylenes, embedded sandwich-style between positive and negative aluminum or indium electrodes. They emit light in the green and yellow portion of the spectrum, and could be used for large-surface displays.

French researchers recently developed the first organic transistor, using short-chain polymers (oligomers) of polythiophenes. Here too, the lifetime was heavily dependent upon the type of insulating layer that surrounded the conductive polymer.

For this reason, it is important to verify as exactly as possible the structure of the contact points between different materials. The processes for producing and interfacing the various materials are therefore critical to the further development of conductive polymers. Once researchers in molecular electronics have solved this problem, similar to one which occurred with liquid crystals, nothing should stand in the way of their victory celebration.

COMPUTERS

European Advanced Networking Test Center Opens in Berlin

92MI0137 Munich MARKT & TECHNIK in German
15 Nov 91 p 8

[Text] For the first time, Europe has the capability for using the FDDI [Fiber Distributed Data Interface] standard to test network components for compatibility under the corresponding ANSI [American National Standards Institute] standard and for interoperability. European developers can now apply to the newly opened European Advanced Networking Test Center (EANTC) at the Berlin Technical University.

The initiator of the EANTC is semiconductor manufacturer Advanced Micro Devices (AMD), which last year founded the Advanced Networking Test Center in California. Since then about 40 manufacturers and developers of FDDI system components have been jointly testing their products there for interoperability. The EANTC operators have agreed on a standardized set of FDDI tests, because the standardization committees have so far failed to define any generally accepted interoperability tests. This wealth of experience is now available to European enterprises too, making expensive

trips to the ANTC unnecessary, although final inspection must still take place in California.

"Opening the EANTC has brought us a step nearer to our objective of making the FDDI test suite available worldwide," said Jochen Polster, AMD's European Marketing Manager for network components, at the opening of the new test center, stressing again that the facility was open to FDDI suppliers of every kind, whether they make chips or systems.

Dr. Klaus Rebensburg of the Berlin Technical University explained that non-EANTC members have to pay 12,000 German marks [DM] for a test series. After signing the contract, the firm concerned has one year in which to have the test carried out.

During interoperability testing, the devices concerned are operated together with several FDDI products from other manufacturers.

The EANTC comprises a "secure room," in which an individual manufacturer can conduct his tests confidentially, and a "group testing room" where up to six partners can carry out FDDI interoperability and performance tests jointly. Both test rooms provide access to the Berlin Technical University's "TUBKOM" test bed, which offers other network technologies such as Ethernet, ISDN [integrated services digital network] and broadband ISDN with transmission rates up to 140 MBit/s. The test environment includes an FDDI ring in which workstations by various manufacturers are accessible for research purposes.

ANTC members worldwide include firms such as 3Com, BICC, Fujitsu, Hewlett-Packard, IBM, Proteon, Schneider & Koch, Sun Microsystems and Ungermann-Bass.

Bulgarian Computer Viruses Massively Infect Western Systems

92AN0081 *The Hague TECHNIEUWS PARIJS*
in Dutch 2 Oct 91 p 14

[Text] According to a news report from Agence France Presse, computer viruses massively invaded Western computers in 1991. They are becoming increasingly dangerous and malicious and primarily originate in East Europe. They paralyzed software packages and destroyed or erased computer programs.

According to Austrian computer experts Kurt Hickisch and Christian Schmid, 1991 will make history as the year of the computer superviruses. "The effect of the viruses developed in East Europe, especially in Bulgaria, is simply devilish," say both computer experts. Viktor Mayer-Schoenberger, manager of the Salzburg-based software company Ikarus-Software which is specializing in developing antivirus programs, explicitly stresses that the phenomenon is a real epidemic which is much more harmful to computers than the computer viruses known to date. Vesselin Bonchev, a Bulgarian expert who runs a

small "virological" laboratory at the Academy of Sciences in Sofia, thinks that 150 out of the 500 viruses known worldwide were developed in Bulgaria. About 10 of these viruses, with an extremely devastating effect, have already infected Western computer systems, especially in the banking and insurance sectors.

In order to illustrate their alarming statements, the Austrian experts quote some of the most feared viruses which have given Western experts sleepless nights since early 1991.

- The "Dark Avenger," probably of Bulgarian origin, infects very quickly and hits the programs and files when they are copied, printed, or simply being used. At the same time, "Dark Avenger" taunts experts by warning them that it is untraceable;
- The "Siamese Twins," also of East European origin, is a new type of virus which is extremely treacherous. It consists of two infected programs which are constantly keeping an eye on each other. As soon as one program is accessed, the other takes revenge by erasing the hard disk completely and by seriously mutilating the programs;
- Computer experts also fear that many computers have already been affected by the "Century Virus." This virus is designed to destroy all infected computer programs on 1 January 2000. So far, experts have not succeeded in tracing the virus.

The Bulgarian and Hungarian connection is not hard to explain. According to Mayer-Schoenberger, many Western companies have had their computer programs and software designed in East Europe since the fall of the Communist regimes in 1988. On average, the production costs are only one-quarter of those in Western countries. Thus, the programs intended for Western Europe are infected right in their country of origin. A lot of computer viruses also invaded Western Europe via computer games which come with every simple computer.

In Bulgaria, the virus developers hardly bother to hide. "We are not stimulated by our jobs. We do have a lot of computers, but we have no work. So we create viruses to take revenge and to find out whether we can destroy the sophisticated Western software systems," says a 23-year-old Bulgarian computer expert who prefers to remain anonymous.

The company Ikarus-Software, which was called upon 5,000 times in 1990 by companies or individuals to trace, destroy, or replace computer programs infected by East European viruses, is now offering practical training sessions in order to make people less defenseless against this "new scourge of modern times."

German Research Minister Reviews Neural Computing Programs

92MI0111 *Bonn DIE WELT* in German 8 Nov 91 p 25

[Article by Heinz Risenhuber: "FRG Minister of Research and Technology: "The Prospects for Neural Computing"]

[Text] Several hundred scientists, mainly in universities, especially at Bochum, Paderborn, Duesseldorf, Bielefeld, and Ilmenau in Thuringia, are currently working on problems regarding neural networks in Germany. It is not only large companies that are working on neural computing systems: There are also a large number of small and medium-sized enterprises working on specific applications, mainly flexible systems for control processes.

Around the end of 1987 and the beginning of 1988, the Federal Ministry of Research and Technology (BMFT) initiated a three-year basic program on "Information processing in neural architecture" (INA) with total funding of around 11.5 million German marks [DM], involving 10 universities, two research establishments, and a medium-sized business. The main aim of the project was to bring together various activities that had previously been running separately in Germany to give them a broad, scientifically viable basis, and to point up initial application prospects.

The work is concentrating on aspects of the technical lay-out of neural architectures, their flexibility, their capacity for self-organization, and the implementation of the associated environmental and technical knowledge required in neural systems. These bases have already been successfully demonstrated using initial examples of applications in the area of information displays, engine control, and language recognition, thanks primarily to successful interdisciplinary cooperation among brain research, biology, physics, and computer science specialists.

This initial funding has attracted distinguished neural computing researchers back from the United States, and the international standing of German applications-oriented neural computing research is now second only to the United States.

With total annual funding of DM10 to 15 million, DM45 million of which have so far been approved. The second phase of BMFT neural computing funding, from 1991 to 1995 is building on the results achieved by INA. A total of 40 research teams, including four from the new laender and eight from industry, are working on the 10 new joint projects currently under way. The scientific objectives are to build, on a small scale, on the basic concepts and demonstrations developed by INA by concentrating on more applications-oriented aspects of neural computing, including the further development of the principles of neural architecture, knowledge processing in neural architecture, the integration of neural networks and artificial intelligence methods (hybrid systems), and robot movement coordination.

The prospects for neural computing research can be predicted, and are in line with the recommendations of the BMFT's panel of experts on the subject. They will bring a major increase in the technical performance of neural computers, followed later by the development of chips and products (achieved and financed solely by industry). Prospective applications for neural computing

will continue to require close contact with neural biology and further collaboration with specialists in knowledge processing (artificial intelligence) and the use of mathematics and information technology to process fuzzy logic.

The successful interdisciplinary approach, which has brought together biologists, brain researchers, and computer scientists to develop neural computing will in the future extend to all areas involving the transfer of biological or biotechnological knowledge to new information technology storage, transport, and processing systems. This field of bioinformation technology will bring together aspects of biology, biotechnology, biochemistry, physics, chemistry, mathematics, and information systems on an interdisciplinary basis, leading to innovative findings in both biology and computer science. The initial goals will involve the implementation of knowledge on cellular automata and genome research. Naturally, this research work in Germany will be open to cooperation and/or collaboration at European and international levels.

Italy's Parallel Computing Program Completes Two-Year Phase

*92MI0118 Turin MEDIA DUEMILA in Italian
Oct 91 pp 86-89*

[Article by Marosa Conforti: "Parallel Computing, the New Frontier of Computer Science"]

[Excerpts] The first results of the "Computer systems and parallel computing" targeted project, presented at CNR [National Research Council] in Rome during the national meeting held to assess the status of research activities and future prospects, are open to question. The parallel computing targeted project, the new frontier in computer science, was approved by CIPE [International Committee for Economic Planning] in 1987 together with other targeted projects and was allocated 63 billion lire in funding. It is divided into eight subprojects that are directed by Bruno Fadini of the CNR Institute for Computing Applications and was launched two years ago. Fadini stated that the goal was (and still is) to develop new and more sophisticated technologies that will make Italian industry more competitive in three major areas: scientific computing for large systems, processors/architectures/languages, and software systems.

During the first two years, relations between industry and universities were entirely unsatisfactory, partly due to the withdrawal of some major industrial groups. The problems experienced by industrialists and others are varied. The general complaint is delayed and inadequate funding, which the project management boards believe could be solved by adding other funding sources (laws for southern Italy or ESPRIT [European Strategic Program for Research and Development in Information

Technologies]). In addition, cumbersome and excessive bureaucracy makes researchers waste an intolerable amount of time.

Satisfactory results were primarily general and theoretical. However, the 618 scientific articles published have been stored in SICP, a data base located at CNUCE [National University Center for Calculation] for inclusion in the international network through the Astra Earn service. Many prototypes have been developed, one of which has been patented.

The following is a detailed description of the eight subprojects.

Sp 1: Scientific computing for large systems. Sp 1, which is divided into three areas—models and simulations, general purpose scientific computing software, networks to access supercomputers—has 32 operating units (universities, companies, public and private research centers) directed by Laura Moltedo from the CNR in Rome. The goal is to use supercomputers to solve highly complex problems in basic and applied science. Work is also being carried out to develop technologically sophisticated software and build up parallel computing expertise. Since research is carried out primarily for the academic world, the results are methodological, that is, aimed at acquiring know-how. New computing codes, functional specifications for new computing codes, and software are developed for different sectors ranging from the geophysical computation of the stratosphere, to simulations such as real-time simulation of a helicopter's flight, to the analysis of remote-sensing data. The research and development of parallel computing methods is particularly segmented and aims at using vectorial and parallel computers to solve: a) direct and inverse problems governed by differential equations with partial derivatives; b) general problems governed by ordinary, functional, and finite differential equations; c) general optimization problems. Finally: time development of methods to solve astrophysics problems is being analyzed.

Sp 2: Dedicated processors. The 41 operating units directed by Franco Denoth of the CNR in Pisa have already produced 100 scientific publications, three complete hardware/software systems, four software systems, and 40 prototypes, some of which are being patented. Denoth explained that the goal of all these activities is to study the simulation and design of models, local equipment, and complex hardware and/or software prototypes based on new processors or on the use of VLSI [very large-scale integration] components on hand. This is being done to obtain the specific dedicated processing power required for signal and image processing and for artificial intelligence. Neural networks are being actively studied to determine their actual use in various applications such as the study of mathematical models for nervous systems, identification of structures and procedures for the development of neural computers, and development of learning and shape recognition algorithms.

In general, all the ongoing research activities have industrial spin-offs. In the prototype area, great curiosity has been aroused by "Autonomouse," a small autonomous robot developed by the Electronics Department at the Milan Polytechnic which is the size of a mouse and has advanced sensorial capabilities. The more advanced version is currently being completed but for the time being "Autonomouse" can perform calculations locally and can be connected to a distant host. It will be used to assess the quality of the automatic learning algorithms developed by "Alecsys," another prototype developed by the Milan Polytechnic.

Sp 3: Parallel architectures. Research concerns general purpose MIMD [Multiple instruction stream, multiple data stream] distributed memory with a large number of processing nodes. The 14 operating units directed by Marco Vanneschi of the Computer Science Department at Pisa University have already developed 15 prototypes with the purpose of elaborating design methodologies and techniques to assess the actual use of highly parallel systems. Parallel systems are considered to be among the most interesting alternatives to the next generation of general purpose machines, since they can function either as workstations or supercomputers. The applications are wide-ranging and include artificial intelligence and neurocomputing, software system development, and the parallel simulation of highly complex systems and phenomena.

"It is a European challenge," Vanneschi emphasized, "because the next generation of computers may be developed using these architectures. If so, what remains to be seen is whether Italian industry is willing to take up this challenge."

Sp 4: New languages. For years, software has been repeatedly accused of being too expensive and of poor quality or, rather, of being seriously limited due to the difficulty of making industrial software as reliable and maintainable as its supporting hardware. According to Franco Turini of the University of Pisa and subproject coordinator, two strategies may be adopted to solve the problem. The conservative strategy aims at keeping old languages and building up a programming environment that will guide and facilitate software development. The more revolutionary strategy focuses on replacing programming structures and getting closer to programs rather than the machine. Turini stated that: Sp 4 intends to demonstrate that the second approach can become an effective solution to industrial software development with wide-ranging applications. The 16 operating units divided into four lines of research have developed nine prototypes. The first line of research—logical languages—aims at improving the industrial applications of logical programming structures by adding programming instructions and by improving implementation techniques. The second line of research, called "Lambrusco," is a program to improve language instructions and concurrent processing models with structures for abstraction, encapsulation, modeling, timing, and definition of abstract data as well as the description of their

space distribution. The "Tasso" project aims at testing a very high level programming environment oriented to the manipulation of mathematical objects. Finally, work is being carried out on LISP [List Processing] with parallel associative memory to implement image processing algorithms.

Sp 5: Advanced data base systems. The 25 operating units directed by Domenico Sacca at the University of Calabria are involved in the following areas of research: intelligent data bases, developing logical retrieval languages, interaction with multimedia data bases, interaction with heterogeneous data bases, and methodologies and tools for the end-user. Although data base technology is rather advanced, the management systems currently available are limited. As Sacca explained, on the one hand they do not allow for complex data definitions and on the other they provide limited data manipulation languages.

In line with other ambitious programs launched in Europe, the United States, and Japan, the 13 prototypes were a first attempt to meet the requirements of new computer applications, ranging from large-scale, inferential knowledge bases, to CAD [computer-aided design] and CIM [computer integrated manufacturing], to geographic data bases and data management for advanced software environments.

Sp 6: Methods and tools for systems design. The 19 operating units directed by Carlo Batini of the La Sapienza University in Rome study the development of advanced software environments with special attention to language, architecture, and meta-environment model analysis. Research activities also aim at defining object-oriented specifications, reusable support tools, programming reusable components, applications of deductive data bases to the creation of graphic environments, and, finally, models of reverse engineering programs and environments. "Specter" and "Infokit" are the two lines of research. "Specter" studies various formalisms such as Petri networks, time logics, object-oriented structures and finite-state robots. All are "strictly" real-time systems. "Infokit" deals with environments aimed at involving end-users, such as models for system specification with applications in office, information management, and information statistics systems. Work is also done on meta-models, the formal tool for the description of the set of models used in a methodological environment, and on aspects related to surface reuse with reference to project dictionaries and libraries.

Sp 7: Intellectual work support systems: Research activities revolve around three main areas: decision-making support and advanced individual productivity systems, expert systems, and hypertext systems. The first case concerns either software or "empty shells" of decision-making support systems targeted for medium-to-high level professionals or clerks with no specific computer background but who need a tool for the independent enhancement of decision-making capabilities. The 20

operating units directed by Cesare Maioli of the University of Bologna have developed a large number of prototypes for different categories of users. For example, a prototype was developed for specialists at Pirelli Tire Coordination to assist them in checking and interpreting diagnostic results contained in data from over 20 plants.

Other prototypes concern the medical sector such as the system for use in monitoring infection in patients who have undergone heart transplants which can handle changes in real time. SLMI, a prototype developed by the musical computer science laboratory of the University of Milan's computer science department, which is the only one to be patented, drew the most attention however. It is an intelligent musical workstation for digital sound editing, color programming (the color of a single note can be changed a billion times), MIDI, computer-aided composition and musicology, and multimedia composition and performance. According to Goffredo Haus of the University of Milan, the Italian music industry which, as many others, has been brought to its knees by Japan, could adopt SLMI, since it is a highly innovative product that can be used to develop an entirely new generation of electronic musical instruments.

Sp 8: Supporting initiatives. This operating unit coordinated by CNUCE at Pisa was established to promote the dissemination of applicational results within the scientific community and to support the project's activities, in particular parallel computing and software engineering. This support consists of tool libraries for use in research, tool performance activities, and tool/benchmark comparisons. According to Stefano Trumphy of CNUCE parallel computing is the very area in which the scientific community most needs to broaden its knowledge in order to catch up with the vectorial and parallel computing technologies of more advanced countries such as the United States. For this reason, training schemes for young researchers and refresher courses for the staff of research institutes and industry have been planned.

At CRIAI in Naples and CNUCE and IET pilot environments for software development will be established, they will be equipped with architectures, tools, and methods to permit researchers, academic circles, and programmers to compare performance in practical cases in a controlled environment.

The round table session. The round table session on "Computer Innovation and Technology Transfer: the Role of the Targeted Project" held at the end of the first day showed that the status of this and other targeted projects are open to question. [passage omitted]

Italy accounts for only 3 percent of world software production. Foreign products are often sold and even when internationally acceptable products are developed, marketing activities are inadequate. Based on the above Galimberti emphasized that the real problem lies in changing the market approach. According to Galimberti, production capacity can be created only if advanced

technology is matched by high level methodology, "that is providing methodologies and skills before products."

On this point, Franco Turini, the coordinator of the "new languages" area of the targeted project, questioned whether "utilitas" was the best option in at least one case, because Italian industry cannot expect to become a hardware leaser but can and must focus on software, and emphasized the importance of methodologies. Turini maintained that high level methodology leads to high level products and that industrialists involved in the targeted project must be given something very close to "veritas" because only this can ensure quality products and therefore an increase in current capabilities.

DEFENSE R&D

Italy: Military Aerospace Program Funding Reduced

92MI0122 Rome AIR PRESS in Italian
2 Oct 91 pp 1925-1928

[Text] The schedules of Table 12 "Defense Ministry Budget for the 1992 fiscal year" of Bill No. 2944 on the 1992 budget, discussed elsewhere in this issue of AIR PRESS, indicate the status of Italian military aerospace programs at the end of last year. The following is a summary of reports on Italy's major military aerospace programs.

AMX The Italian-Brazilian jet fighter is the subject of Schedule 12, "Explanatory report on the current status of Law No. 456 dated 6 August 1984" (where reference is also made to the Italian-British EH101 helicopter and to Catrin, the army's field communications system), and of the already mentioned Schedule 14, Annex 1. According to Schedule 12 two contracts were signed between, 1 January and 31 December 1990 but as to the overall situation "several contracts and memoranda of understanding have been signed for a total value of 929.8 billion lire. By 1993, another 217 billion lire will be spent to complete the program, which is therefore expected to cost a total of 1,146.8 billion lire."

Pursuant to Law No. 456/84, 470 billion lire were appropriated for the AMX from 1984 (including the 1983 share) to 1989. Schedule 12 indicates that "although the law allocated 470 billion lire in funding, the expenditure up to 1993 is expected to be 1,146.8 billion lire."

Why are funds insufficient? Schedule 12 notes that: "The fixed allocation made under Law No. 456/87, is insufficient and cannot be adjusted for inflation. Funding was based on the economic situation at the time the project's financial requirements were assessed, that is, three years before the law was passed; second, increases in aeronautics costs have outpaced inflation; third the lira lost value against the dollar (a particularly important aspect in engine contracts). According to the document, this led to the postponement of other major programs and will

prevent the completion of major programs to upgrade the armed forces (the air force) included in the ordinary budget."

Schedule 14 under "AMX and AMX/T—Development, Industrialization, and Production" notes that: "Due to the lack of available funds, production is restricted, for the time being, to the first three lots of 136 aircraft instead of the planned 238." A summary of programs funded under the ordinary budget under Chapter 4051, "AMX and AMX/T—Development, Industrialization, Production: 1st, 2nd, and 3rd Lot," provides the following figures: quantity, 136; total estimated expenditure, 7.82 trillion lire (1990 chapter allocation plus the 1987/88/89 balance minus the balance as of 31 December 1990); duration 1984-1995; expenditure in 1990, 593 billion lire; state of completion in 1990, 9 percent and 95 percent as of 31 December 1990."

EFA [European Fighter Aircraft]—Schedule 14 reads: "Pending the definition of an ad hoc measure to fund the program, the Italian air force has met its 1990 requirements by advancing funds from its own ordinary budget." The summary called "Programs funded under the ordinary budget," provides the following data: EFA (development, industrialization, production, support); quantity, 165; estimated expenditure, 10.842 trillion lire (as for the AMX), duration 1998-2005; 1990 commitment, 334 billion lire; state of completion in 1990, 10 percent, and 25 percent as of 31 December 1990.

Spada According to the report in schedule 14 Annex 1: "The program, provided for under Law No. 38/77, was launched in 1980 and originally concerned the purchase of 20 batteries based on two converted firing sections, and subsequently 16 batteries based on three converted firing sections. Due to the limited amount of available resources, only 12 batteries have been purchased so far." The summary provides the following figures: quantity, 12 batteries; estimated expenditure, 2.048 trillion lire; duration 1980-1994; 1990 commitment, 95.7 billion lire; state of completion in 1990, 5 percent and 65 percent as of 31 December 1990.

EH101 It is the subject of Schedules 12 and 14, entitled "Explanatory report on the status of programs under Chapter 4031 as of 31 December 1990"—Maristat (Navy General Staff) planning body. The paragraph is Schedule 14 on "Programs Associated with Special Laws" notes that: "These programs lasted longer than expected and costs have exceeded allocations made under the relevant implementing acts (due to very high inflation rates between 1970 and 1985). Therefore, the programs are being completed with the ordinary resources of the defense budget."

According to Schedule 12, 600.9 billion lire were committed under the two contracts and memoranda of understanding for this helicopter program to be carried out in collaboration with the UK. Schedule 12 states that: "By 1991, another 58.9 billion will be spent to

complete the program. The total cost of the program is therefore estimated at 659.8 billion lire."

Pursuant to Law No. 456/84, 300 billion lire were to be spent for the EH101 between the 1984 (including the 1983 share) and 1989 fiscal years. The reasons for the program's increased costs are said to be the same as for the AMX. Indeed: "The navy funded the largest share of the (352.3 billion lire) with ordinary budget funds. This led to the postponement of other major programs and will prevent important budgeted programs to upgrade the navy from being completed."

The paragraph in Schedule 14 under "EH101 helicopter research and development" (Law No. 456/84) highlights: "the Italian Navy's need for the onboard multipurpose naval version for integrated air support to offshore operating units," and states that, "whose feasibility and project definition stages began in 1979, was able to continue with the more expensive development stage in 1984 following the allocation of 300 billion lire under Act 456/84." The summary provides the following data: quantity, [N.A.]; total estimated expenditure, 683 billion lire; duration 1979-1993; expenditure in 1990 6.4 billion lire; state of completion in 1990 1 percent and 88 percent as of 31 December 1990.

Tornado The summary (Chapter 4051) provides the following information on the status of the program: quantity, 100; total estimated expenditure, 7.746 trillion lire; duration 1969-1997; expenditure in 1990, 215 billion lire; state of completion in 1990, 5 percent and 95 percent as of 31 December 1990.

Tanker The summary of the Italian Air Force's B707 Tanker program provides the following information: quantity, four; total estimated expenditure, 275 billion lire; duration 1985-1991; expenditure in 1990, 50 billion lire; state of completion in 1990, 6 percent and 56 percent as of 31 December 1990.

G.222 Schedule 14 states that the program: "is for the purchase of two aircraft to replace similar aircraft destroyed in operation and another two for Civil Defense." The summary provides the information: estimated expenditure, 125 billion lire; expenditure in 1990, 105 billion lire; state of completion in 1990, 10 percent and 40 percent by 31 December 1990. The G.222 is also included in the maintenance and replenishment programs funded under budget heading "G.222—half-life upgrading" to meet the operational requirement of "improving the aircraft's operating capability."

The summary provides the following information: quantity, 46; total estimated expenditure, 310 billion lire; duration 1986-1994; expenditure in 1990, 0.6 billion lire; state of completion in 1990, 5 percent and 10 percent by 31 December 1991.

HH-3F Schedule 14 states that: "The program, is for the purchase of 11 helicopters." The summary provides the following information: quantity, 11; total estimated

expenditure, 280 billion lire; duration 1973-1992; expenditure in 1990, 52 billion lire; state of completion in 1990, 10 percent and 60 percent as of 31 December 1990.

A-129 This program appears under the "A129 armed helicopters" heading in the "Explanatory report on the status of programs under Chapter 4011 as of 31 December 1990" by the General Staff of the Armed Forces' planning body under Schedule 14 "Upgrading programs funded under the ordinary budget." The document reads: "The program calls for the purchase of 60 helicopters together with the relevant logistics and administrative support. The first stage involving 15 helicopters has been completed (...)

The second stage, which will bring the program to completion, is about to begin. The overall expenditure, including costs borne during the development stage, amounts to about 1.8 trillion lire, 95 billion of which were spent in 1990."

The summary of the A-129 program (whose operational requirement is: "the establishment of two groups of anti-tank helicopter squadrons") provides the following information: quantity, 60; total estimated expenditure, 1.8 trillion lire; duration 1986-1994; expenditure in 1990, 95 billion lire; state of completion in 1990, 5.2 percent and 65.3 percent as of 31 December 1990.

Helios and Sicral The Helios remote-sensing satellite appears in Schedule 14's "Explanatory report on the status of programs under Chapter 7010 as of 31 December 1990" by the Segredifesa (USG) programming body. The document reads as follows: "The goal of the project is to develop a system that will take pictures of the Earth's surface excluding the polar caps. It will consist of a space segment (launchers, satellite, orbiting center) and Earth segment (centers for image detection, processing, and usage). Its development is divided into four stages: study, definition, construction, and launch. Italy will contribute about 220.8 billion lire (14.1 percent of the total) up to 1992. The project is an Italian-French-Spanish joint venture. The participation of the Ministries of Scientific Research, Civil Defense, Agriculture and Forestry, as well as the CNR [National Research Council] is possible. Their financial participation in the program has neither been requested nor considered however. Under an agreement signed by Italy, France, and Spain the system will be used in proportion to their funding shares. Industrial spin-offs will be equal to each country's participation in the program. The development stage, which has already begun, is expected to end with the launch in July 1993."

On SICRAL, the Italian telecommunications and alarm satellite, the same report points out that: "In 1990, results began to be assessed. Findings of this assessment will be used to decide whether or not the project should be continued. No funds were allocated for the program during the year."

ENERGY, ENVIRONMENT

EC Environment Council Policy Decisions Reported

Results Discussed

92WS0082G Brussels EUROPE in English
3 Oct 91 pp 7-8

[Article: "(EU) Environment Council: The Council States That the Commission's Communication Relation To the Strategy To Stabilise CO₂ Emissions Is the Cornerstone of the EC's Policy on Climate Change—Working Party Set Up"]

[Text] Luxembourg, 02/10/1991 (AGENCE EUROPE)—At the conclusion of Tuesday's Environment Council, its President-in-Office, Dutch Environment Minister J.G.M. Alders, confirmed (see yesterday's EUROPE, page 9) the favourable reception all the delegations gave to the Commission's Communication setting out a Community strategy to limit CO₂ emissions (EUROPE of 26 September, page 7). The three elements of the Communication must now be analyzed in detail: 1) non-tax measures, 2) national programmes, and 3) taxation aspects, notably the fact that the tax proposed by the Commission would involve an average 50 percent increase in energy prices, particularly in the price of fossil fuel. For this reason the Council has decided to set up a working party that is expected to report its conclusions at the joint Energy/Environment Council on 10 and 11 December which would close the procedural work. The Minister expressed the hope that this Council would invite the Commission to submit specific and formal proposals. The working party should notably analyze the Commission's Communication in relation to the individual situation in each Member State, particularly from the standpoint of burden sharing. In conclusion, the Council President said that everyone has known since the Luxembourg meeting of October 1990 (when the EC made a commitment to stabilise CO₂ emissions in 2000 at the 1990 level; while agreeing to this principle at the Community level, the United Kingdom opted for the deadline of 2005, Ed.) that the EC would be under pressure to attain this goal. The EC position is essential in the context of the preparation (currently deadlocked) of the UN Environment and Development Conference which will be held in Rio de Janeiro in June 1992.

Commissioner Carlo Ripa di Meana stated that the Commission's Communication had experienced an "overwhelming success I had not dared hope for." Several delegations voiced their enthusiasm (Italy, Belgium, Spain, France and Germany, which had already expressed their view on its content), others such as the United Kingdom expressed "good will." The Commissioner stated that the specific and formal proposals that will follow could be ready next spring, prior to the UN conference in Rio de Janeiro. This will depend, however, "on the Council's requests along these lines." Lastly,

Carlo Ripa di Meana said the working party would concentrate on the energy and environment aspects while a sub-group would evaluate the tax implications.

The following is the text of the Council statement:

"The Council welcomes the Communication from the Commission setting out a strategy to stabilise CO₂ emissions in the Community in general at 1990 levels by the year 2000. The Council recognizes the great importance of the Communication as a cornerstone for the establishment of a climate change policy in the Community.

The Council attaches great importance to reaching a firm position at the combined Energy/Environment Council meeting on 10 December 1991 on the instruments needed to implement the Community's commitment to reach stabilisation of CO₂ emissions by the year 2000.

The Council agreed that intensive preparation work should be undertaken on the basis of the Commission's Communication, taking into account all the various interests involved."

Environment Council: Agreements on "NORSPA" and the Rationalisation of Work, Progress on Natural Habitats and "Life"—Several Decisions Expected in December

Luxembourg, 02/10/1991 (AGENCE EUROPE)—At the conclusion of the Environment Council on Tuesday evening, President-in-Office Dutch Minister Mr. J.G.M. Alders announced that finally, after three years of work, the Council could take a decision in December on the directive concerning natural habitats. Indeed, after lengthy work in restricted session, an agreement was reached on the financing of this directive. Two views were in opposition: Spain deemed Community financing necessary whereas Germany took the view that the cost of the directive should be borne nationally.

Taking into account the fact that the EC as a whole has as great an interest as the Member States in creating protected zones, a compromise was found, the Council President said, adding that responsibility for the programmes implemented in the framework of the directive remained national but that on an exceptional basis Community co-financing was possible in certain cases. "A good written formula now remains to be found," said the Dutch Minister, who thinks this should be possible in December. The President also mentioned the favourable reception the Council gave the Commission's proposal concerning the reduction of CO₂ emissions (see above) and said the Council had also favourably welcomed the Commission's Communication entitled "A Common Platform. Guidelines for the Community for UNCED 1992." The latter is in preparation for the UN Conference on the Environment and Development to be held in Brazil next June. The Communication will be examined in depth with a view to framing a Community position likely to contribute optimally to the success of the

conference. Two working parties will meet this week, one on technology transfer and the second on financial means.

The following is an overview of the results of the Council sitting.

1) NORSPA—environmental protection in the Community's northern coastal regions. The Council expressed its agreement with the regulation introducing this action, which will be allocated 16.5 million European currency units [ECU] for 1991-1992. EUROPE will return with details at a later date.

2) Standardization of reports concerning the implementation of certain environment directives. The Council voiced its agreement on the directive; formal adoption will take place at an upcoming Council. The goal of the directive is to facilitate the task of the Member States and the Commission by allowing them to better monitor and evaluate the implementation of such directives, notably by harmonizing the presentation, content and frequency of reports in the light of acquired experience. The agreement provides to this effect the preparation of implementation reports for the directives concerned based on uniform questionnaires presented by the Commission to the Member States six months before the start of the period covered by the report. The agreement also enjoins the Member States to forward the reports to the Commission within nine months following the end of the three-year period covered. The system is based on a three-year rotation, each year being devoted to a specific subject, air, water and waste.

3) Titanium dioxide industrial waste. See yesterday's EUROPE, page 10 and below.

4) Conservation of natural and seminatural habitats and flora and fauna. Following a lengthy debate, notably of the financial aspects and the mechanisms for the designation of the zones to be protected, the Council, having noted substantial progress, assigned the Permanent Representatives the task of pursuing the examination of the directive with a view to reaching agreement at an upcoming Council.

5) LIFE—financial instrument for the environment. The Permanent Representatives have been asked to continue their work, taking into account Parliament's opinion as soon as it has been issued, so that the Council may reach agreement at the earliest opportunity, if possible before the end of the year.

6) Assessment and monitoring of the environmental risks of dangerous substances. Having reviewed the progress of work in this area, the Council intends to reach agreement in December.

7) Community system for awarding the ecological label. The Council hopes to reach agreement in December.

8) Exports and imports of certain chemicals. The Council hopes to reach agreement in December.

9) Control of the trans-border movements of dangerous waste—Basel Convention. The Council stressed the need to adopt legal instruments allowing Community application of the Convention as soon as possible. The Council is awaiting the Parliament's opinion on the proposal for a regulation which will ensure consistency between the extra- and intra-Community aspects of the control of the movements of waste and will return to this matter at its December session.

10) "Clean lorries." The Council adopted the directive concerning an additional reduction in the limit values of pollutants from diesel engines used in lorries and other utility vehicles. EUROPE will return with further details soon.

NORSPA Program

92WS0082H Brussels EUROPE in English
4 Oct 91 p 12

[Article: "(EU) EC/Environment: The 'NORSPA' Programme Is Approved for Two Years With Possible Extension"]

[Text] Luxembourg, 03/10/1991 (AGENCE EUROPE)—As announced in yesterday's EUROPE, the Environment Council reached political agreement on the regulation concerning the NORSPA programme based on a compromise solution; the regulation will be formally adopted at an upcoming Council. The compromise reached provides for a two-year NORSPA programme with financing of ECU6.5 million for 1991 and ECU10 million for 1992, as had already been agreed. The revision clause, however, has been maintained: the Commission may therefore propose an extension of NORSPA, which would be given the same treatment as the MEDSPA programme, on which agreement was reached in the Council last December (see EUROPE of 28 December 1990, page 7). The MEDSPA programme was formally adopted in March for a five-year period. With this most recent decision, a parallelism will be maintained between NORSPA and MEDSPA, as the Council had agreed at its session last June.

EUROPE recalls that NORSPA concerns the northern regions of the EC, namely the estuaries and coastal waters of the Irish Sea, the North Sea, the Baltic, the northeastern part of the Atlantic located north of the river Tagus, as well as the Azores, Madeira and the Canary Islands (MEDSPA concerns the Mediterranean). The objectives sought in the NORSPA and MEDSPA programmes are to intensify efforts to protect the quality of the environment and to increase the efficacy of Community environmental policy and actions in the regions concerned. Financial support could notably take the form of capital subsidies to encourage investments in areas other than infrastructures or financial contributions for pilot or demonstration projects. The maximum Community contribution is set at 50 percent for public investments and 30 percent for private investments.

Emission Reductions

92WS0082I Brussels EUROPE in English 4 Oct 91 p 12

[Article: "(EU) EC/Environment: Adoption of Further Reductions in Polluting Emissions"]

[Text] Luxembourg, 03/10/1991 (AGENCE EUROPE)—The Environment Council has adopted by tacit procedure the directive concerning a new reduction in the limit values on polluting emissions from diesel engines used in lorries and other utility vehicles, amending the 1987 directive. EUROPE recalls that a common position was reached on this directive at the May Council, following the political agreement reached at the session on 18th March last. Since the European Commission did not incorporate the amendments voted by the Parliament, the directive that was formally adopted is identical to the common position. It provides that the Member States must reduce the limit values of polluting gas emissions (carbon monoxide, hydrocarbon and nitrogen oxide) and, from now on, the limit values of particulate emissions from the vehicles in question. EUROPE recalls that this reduction will occur in two phases: 1st phase: 4.5 g/Kwh for CO; 1.1 g/Kwh for HC; 8 g/Kwh for NoX and 0.36 g/Kwh for particulates; 2nd phase: 4 g/Kwh for CO; 1.1 g/Kwh for HC; 7 g/Kwh for NoX and 0.15 g/Kwh for particulates. The dates of entry into force vary according to the type of vehicle for both phases, as follows: a) 1st phase for "new types of lorries" 1 July 1992, b) 2nd phase "new types" 1 October 1995, c) 1st phase "released into circulation" 1 October 1993 and d) 2nd phase "released into circulation" 1 October 1996.

The Commission has been requested to make proposals to the Council before the end of 1996, in the light of the progress made, for a downward revision of the limit values applicable beginning on 1 October 1999.

European Wind Energy Projects Assessed

92AN0017 Antwerp DE FINANCIËLE-
EKONOMISCHE TIJD (Supplement 2) in Dutch 15
Oct 91 p 13

[Article by Guy Van den Broek: "Importance of Wind Energy Remains Limited, But Efficiency Can Be Improved—Clausen: Wind Energy Is Expensive Because Fossil Fuels Are Too Cheap"]

[Text] Ditmarschen—Electricity generated by wind energy can lead to fuel cost reductions within the framework of a national power supply scheme; it can, however, not lead to a reduction in overall capacity since its production is too unpredictable for that. In addition, in a country like Germany, wind energy can represent no more than 1.5 percent in the national fuel bill, even if all favorable locations are put to optimal use. In Germany, the cost of wind energy is about four times that of conventionally generated energy. Thus, wind energy farms can only be operated profitably through public investment subsidies.

These conclusions were arrived at by Dieter Clausen, manager of the "Westkueste" wind energy farm in the North-German state of Schleswig-Holstein, which is owned by Schleswig AG. However, in spite of the relatively high cost, Clausen remains an advocate of wind energy. Through experiments, he is trying to optimize the energy efficiency of wind farms.

In the formula used for calculating the potential capacity of wind turbine generators, the power generated is proportional to the cube of wind speed. In other words, the energy output strongly increases with wind speed. Only areas with persistent wind speeds of 4 up to 6 meters per second can be used. These areas are found almost exclusively along the coast, at high altitudes, and in mountainous areas. Entire regions in Europe are therefore not appropriate for wind energy development.

And yet, Clausen strongly believes in the future of wind energy. He argues that any form of alternative energy deserves maximum attention, because the present fuels, such as coal, oil, and natural gas, will be completely exhausted within the next few hundred years if the present Western consumption patterns are maintained.

Research

Since the Middle Ages, windmills have been turning on the European continent and the Chinese had windmills even before our era. Anyone who believes that this simple technique cannot be further improved given the present state of technology, is mistaken. In the Schleswig-Holstein wind farm, new experiments are being conducted every day.

These experiments are related to the size of the aerogenerators; the length of the rotor; the use of one-, two-, or three-bladed rotors; power transmission toward the generator; aerogenerator height; environmental aspects; and, in particular, the layout of the aerogenerator farm in order to achieve maximum output.

The experiment with the Growian, a single aerogenerator with a capacity of 3.2 megawatts and a 100-meter-long rotor, was discontinued because the output fell short of expectations after a few years. According to Clausen, optimal output can only be obtained through a proper wind farm arrangement, using smaller as well as a few larger aerogenerators (1.3 megawatts).

It is incredibly difficult to examine the wind's exact behavior. One small irregularity in the landscape can result in wind changes causing a sharp decrease in an aerogenerator's efficiency, even if it is located at a reasonable distance from that irregularity. In Clausen's opinion, few wind farms are operated in a professional way and under optimal technical conditions.

Another ongoing experiment focuses on wind power transmission to the generator, for instance, a system in which not only the rotor but the entire shaft rotates, thus ensuring a more direct transmission of energy. Wind energy efficiency is open to many, however small,

improvements, but the main decisive factor remains speed, efficiency being proportional to the cube of speed.

Expensive Energy

In fact, only little is known so far about the economic aspects of wind farms in Europe. Denmark has the greatest proportion of wind energy. In the United States and more especially in California, wind farms are more common. However, a few constants always emerge. For instance, electricity generated by wind energy is always more expensive than electricity generated by fossil fuels.

However, energy experts agree that the present generation is extracting the world reserves of fossil fuels (coal, oil, and natural gas) much too cheaply, at the expense of future generations. A comparison of the present price of wind energy with that of fossil fuels therefore gives a distorted view of the situation.

Assuming an optimum operation of the wind farms, an average power price of 0.27 German marks [DM] or 5.5 Belgian francs per kilowatt-hour (kWh) can be obtained in Germany. Large coal power stations are still producing power at an average price of DM0.09 per kWh, which is about one-fourth the price of wind energy. Thus, only so-called "peak rates" can be charged for wind energy. Peak rates are charged when electricity requirements exceed specific quotas in a certain region so that additional capacity is required. This above-average consumption is more expensive and, at that price, wind energy becomes competitive. However, wind farms cannot really serve as a buffer capacity for peak consumption, because of the wind's unpredictable availability.

In addition, not all wind farms manage to reach this average price of DM0.27 per kWh. In regions with wind speeds of fewer than 4 meters per second, as well as in farms with insufficient capacity, the price can easily be many times higher than this. Another key aspect determining the cost price is the depreciation period of the aerogenerators, which is generally estimated at some 10 years.

An essential factor in the efficiency calculations of wind energy farms is the distance from the often remote wind farms to the grid. The cables needed to transfer the generated power to the grid are expensive and the transfer itself involves losses of efficiency. These costs should also be borne by the authorities if it is decided that wind is to supply a part of a country's power requirements.

Netherlands

The Netherlands has some of the most favorable spots in Europe for generating wind energy, and the government is taking full advantage of this situation. In 1985, a wind energy program was launched, aimed at reaching a wind power capacity of 1,000 megawatts, spread over different phases. It is one of the most ambitious programs in Europe.

During the first phase (1985-90), it was planned to build a capacity of 100 to 150 kilowatts. According to a spokesman of the Dutch Ministry of Economic Affairs, this objective was reached, even though 1 year behind schedule. Under this initial action program, private investors willing to install a wind farm could receive up to 40 percent in investment subsidies from the government.

Under the second action program, which will extend until 1995, the Dutch power distributors themselves are charged with building a total wind capacity of 250 megawatts. They are granted subsidies amounting to 20-25 percent of their investment cost. Every year, the Dutch Government appropriates 30 million guilders to finance this program.

At the end of 1995, the Netherlands will have a wind farm capacity of 400 megawatts. Once the program has been completed, wind energy will account for a little more than 1 percent of the total energy. According to the Ministry of Economic Affairs, all durable energy forms combined will provide approximately 5 percent of the total energy supply in the Netherlands by 2010. The wind farm operators write off their installations over a period of roughly 10 years.

Thanks to the investment subsidies granted by the Dutch Government, wind energy is capable of competing with conventional power stations. They can charge a rate which is comparable to that of the large-scale producers, i.e., about 0.15 guilders per kWh. A "stiff competition" is thus created between small and large-scale power producers, says an official of the Ministry of Economic Affairs.

The economic viability of wind energy in the Netherlands is to be attributed to the high wind speeds along the Dutch shores, which can reach up to 6 meters a second. In addition, the development of aerogenerator technology is already in an advanced stage, thus allowing considerable cost reductions. For private investors, the former 40-percent investment subsidy scheme remains applicable.

In Germany, wind energy is still in a more experimental stage; at the end of 1988, the country had only 188 wind farms with a total capacity of 11 megawatts and a production of 8.3 million kWh. Most of them are located in Schleswig-Holstein, because of its favorable location.

Early 1989, the German Federal Government launched a program for the construction of 100 aerogenerators with a total capacity of 24.5 megawatts. At the end of 1989, the Federal Government decided to launch a 100-megawatt wind program. Under this program, operators of wind energy farms are granted a subsidy which corresponds to DM0.08 per kWh supplied.

However, the introduction of such a wind energy program in any country requires a strict separation between electricity production and distribution. As a matter of fact, this condition applies to all forms of alternative

power generation. In countries like Germany and the Netherlands, this condition has already been met.

Such a separation makes it easier for the authorities to implement specific programs and to grant subsidies. It also makes it easier to determine the structure and basic cost of electricity and it enables the government to grant direct subsidies to wind farm operators, either in terms of investments, or in terms of electricity production per kWh.

Thus, there must be a clear-cut separation between electricity production and distribution costs. This situation is, for instance, impossible in Belgium, because there is only one production company which also controls 90 percent of distribution, as well as the price-fixing system, through mixed intermunicipal companies. With its limited shoreline, wind energy can only make a minor contribution in Belgium, but it is rather the structure of the electricity sector that constitutes a major obstacle.

Germany: Photovoltaic Hydrogen Production Prototypes Presented

92WS0083A Paris INDUSTRIES ET TECHNIQUES
in French 4 Oct 91 p 36

[Article by Christian Guyard: "Germany Believes in Hydrogen"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] Already here: prototype installations for photovoltaic or hydraulic power hydrogen production. Seen at Achema in Frankfurt.

Will we one day live in a hydrogen civilization like we now live in an oil civilization? A civilization which will use hydrogen instead of gasoline as energy for its personal transportation. A civilization without hydrocarbon emissions, nitrogen oxides, and other black clouds, and one which will no longer emit carbon dioxide. An illusion? Economically, yes; technologically, much less so! Hydrogen, energy source of the future, was earmarked a whole showroom at the world chemistry meeting, Achema, in Frankfurt. This was an opportunity to learn about the present developments of the German industry and its long range objectives.

Hydrogen can be produced and stored using solar energy, which is converted directly into electricity by photocells supplying water electrolyzers, and which in turn produce hydrogen and oxygen. The hydrogen then has to be processed to supply vehicle batteries. Another technique uses hydroelectric power. The Germans are considering the production of hydrogen in Canada, which has a huge supply of electricity derived from its enormous hydroelectric plants, and the transportation of this hydrogen in liquid form at -273°C to a European port such as Hamburg. These projects should have a strong appeal for the Greens, particularly in light of German studies conducted by Tuv, which show that the electric car ecological solution would barely reduce atmospheric

pollution (except for nuclear power). In that case, the only true ecological solution would be hydrogen.

Electrolyzers With 90 Percent Instead of 65 Percent Efficiency

The first large German experiment, since mid-1989, together with Saudi Arabia, has been a 350 kW photovoltaic installation which can supply 170,000 Nm³ of hydrogen per year. To test the relationship between photovoltaic techniques and electrolyzers, a 10 kW installation is operating near Stuttgart since mid-1988. It consists of 720 modules of polycrystal silicon supplying low temperature alkaline electrolyzers. The hydrogen produced is compressed and sold locally. The third experimental site, at Nuremberg in Bavaria, has been in service for one year in a region where the average sunlight does not exceed 1800 hours per year. A SARL-type company was created by Bayernwerk (60 percent) together with BMW, Linde, MBB, and Siemens (10 percent each). The first phase of the project, which is ending this year, will have cost 64 million marks. The Bavarian State and the German Ministry of Research (BMFT) covered one-half of the operating costs. A full production and utilization line is in prototype test at that site. The photovoltaic portion consists of 3000 m² of single crystal (Siemens) and polycrystal (TST) photovoltaic modules, which supply a total of 278 kWc. An electric conversion and regulation installation delivers 211 kW to the electrolyzers. Two technologies are being compared: Krebskosmo alkaline electrolysis with polysulfonate diaphragm, and ABB water electrolysis with Nafion ionic membrane. These are advanced electrolyzers whose efficiencies reach 85 and even 90 percent; they are superior to the conventional 60 to 65 percent electrolyzers. Production should reach 50,000 Nm³ of hydrogen per year. The gases they produce are used to test various applications: 80 kWel alkaline electrolyte (Siemens) or phosphoric acid (KTI) fuel cells, vehicle cryogenic storage, and direct combustion. The latter can take place in catalytic burners developed by the Fraunhofer Institut, or in high pressure and high temperature steam generators perfected by DLR. Generators of this type, from 40 to 70 MW, are being tested at thermal power plants as rapid auxiliary power sources.

Germany: High Volume Desulfurization Process Developed in Ex-GDR

92WS0090A Paris INDUSTRIES ET TECHNIQUES
in French 6 Sep 91 p 56

[Article by Valerie Borde: "Thermal Power Plants: Large-Scale Desulfurization"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] Pollutant emissions from the Boxberg thermal power plant, in the former GDR, are 15 times higher than German standards will allow. Overhauling the plant will cost several billions.

It could be less dreary. The Boxberg thermal power plant, a few kilometers from the Polish border, produces

20,000 tonnes of pollutant emissions every year, according to its own management's figures. The sulfur oxide content is 3 grams per cubic meter [g/m^3], although the permissible limit in Germany is 0.2 g/m^3 . In short, this power plant produces almost more pollutants than electricity. Yet, it cannot be closed down right away: the Boxberg power plant produces one fifth of the former GDR's electricity.

200,000 m³ of Water Diverted Every Day for Steam Production

VEAG [state-owned electric company], the company that now manages the power plant, asked the ABB group [Swedish General Electric Corporation-Brown Boveri] to design an emission-desulfurization unit. It will cost 3.5 billion francs [Fr]. The technology to be used is still in the development stage. Actually, although ABB specializes in facilities of this type, it never thought it might have to scrub so much sulfur oxide at one time!

The desulfurization technique is based on lime scrubbing. The gas flow is directed to a lime (calcium oxide) solution which reacts with sulfur to produce gypsum (calcium sulfate). The gypsum can then be used in the construction industry. Another advantage of this method is that it does not produce effluents that would have to be scrubbed in turn. ABB has already applied this concept in two West German lignite power stations operated by RWE [Rhine-Westphalian Electricity Works]. But pollution there was not as bad.

Why so much sulfur? For a simple reason. The Boxberg power plant, the construction of which started in 1968, burns 100,000 tonnes of lignite per day. The lignite comes from three nearby open-pit mines, which contain reserves estimated at 1.8 billion tonnes. Unfortunately, the lignite contains close to 10 percent of sulfur, whereas the coal used in the West contains less than 1 percent. To produce steam, 200,000 m³ of water are diverted daily from two rivers, the Spree and the Schoeps, and heated by burning lignite. The lignite ashes are then separated in an electrostatic filter and sent to silos. But the efficiency of the electrostatic filter is estimated to be 97.6 percent. To bring the power plant up to German emission-control standards, this filter will have to be complemented by the desulfurization unit.

Only the two most recent units, producing 500 megawatts [MW] each, will be equipped. The other twelve 210-MW units will eventually be closed down. Work is expected to start at the end of 1992, and Boxberg should comply with German standards in July 1996. One last fact: 85 percent of the former GDR's electricity is produced in power plants of this type (compared with 20 percent in the West). And Boxberg is the most modern of them....

Solar Energy Tested in Spain

92MI0066 Stuttgart LASER UND OPTOELEKTRONIK in German Oct 91 p 16

[text] A solar furnace for the maximum temperature range was inaugurated on 10 July in the grounds of the Almeria Solar Platform (PSA), the largest solar test center in Europe. The park is operated by the Spanish CIEMAT (Center for Energy, Environment and Technology Research) and the German Aerospace Research Institute (DLR). The project was financed out of European Community funds. The furnace consists of several parts: four 54-m² round, flat reflectors, the heliostats, track the position of the sun so that they constantly reflect the sunlight onto a parabolic reflector, the concentrator. These reflectors are driven by servo motors and controlled by microprocessors. The curved parabolic reflector, which comprises around 90 facets, concentrates the solar radiation on to a focus in the center of the solar furnace building, where it should then be possible to reach temperatures of around 3,000°C. The heat is produced "cleanly," i.e., without polluting residues or consumption of fossile energy sources. Material samples can be heated directly without the interference of crucible walls. For this reason, the solar furnace is of particular interest to material scientists.

FACTORY AUTOMATION, ROBOTICS

EC: Four High Power YAG, CO₂ Lasers for Welding Presented

92WS0077B Paris INDUSTRIES ET TECHNIQUES in French 4 Oct 91 pp 33, 34

[Article by Claude Gel: "The Race to Power; Laser Machining"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] Four European manufacturers have exceeded the 1-kilowatt [kW] mark in YAG [yttrium-aluminum garnet] laser. CO₂ lasers, too, are becoming more powerful and more compact. Here is what we saw at the Laser 91 Show (Munich).

Machining lasers are making spectacular headway; at the Laser 91 show, the Triagon, a 5-kW CO₂ welding laser introduced by WB-Laser got star billing. WB-Laser, a small to midsize Munich firm has taken over the operations of the former German subsidiary of Photon Sources. The name of its laser is based on its shape: the resonator tube is folded to form a triangle. It uses an original semiproprietary technology, with only four mirrors, the assembly having an inclination of 45x so as to eliminate one phase of the polarization beam. A smaller model, designed for cutting and operating on an Elasmaco XY-table, was introduced before, at the World Machine-Tool Show (EMO) in Paris. Next to Rofin-Sinar (Siemens) and Trumpf, WB-Laser thus strengthens the potential of German laser-manufacturers as they are about to face competition from Japanese electronics

giants. Fanuc, for instance, announced that it would market its lasers in Europe through GE Fanuc Automation.

The multikilowatt YAG sources developed under the Eureka program EU-226 (Eurolaser) also received much attention in Munich, especially at the Quantel booth. "With this 1.2-kW YAG, we can weld stainless titanium alloys 3 mm thick at the rate of 500 mm per minute, and next year we shall have a 2-kW unit for plates up to 8 mm thick," we were told by Dominique Cilia, head of the Eurolaser project at Quantel. In Munich, his multikilowatt source was working on a numerical-control welding machine made by Cheval Freres, a Besancon company that is also a partner in the EU-226 project.

Quantel, the prime contractor and a subsidiary of the Unilaser economic interest group (Aerospatiale) is the first European company to market a modular industrial line with four YAG ranging from 300 W to 1.2 kW. As for Cheval Freres, it also manufactures YAG's. The company recently designed and developed a fiber-optic dental laser. It is working to develop its own industrial 1-kW source to complete its line, which goes up to 600 W. BMI [expansion not given], the third French small to midsize firm working on the Eurolaser project, also developed a 1-kW YAG source. It already introduced it at the EMO show. Last, the German firm Haas-Laser, also under the banner of Eureka, exhibited in Munich the prototype of a 2-kW continuous-emission laser.

Capable of Drilling Holes 75 mm Deep

The surprise however came from an outsider, the British ElectroX, with the announcement—independently from Eureka—of a 2.4-kW YAG source, the most powerful known to date! "The first unit will equip the Spanish Novara Laser Institute in Bilbao, and a 1.6-kW model is already in operation at General Motors in the United States," we were told by Jean-Charles Blondio, of the Mya-Lasers company which represents ElectroX in France.

What should we make out of this race to multikilowatt lasers which, in fact, brings new competitors to the already crowded industrial YAG market? Lumonics, until now the world leader in that technology, would naturally have preferred more EC aids to promote industrial applications. Gilles Arie of Lumonics-France commented on this: "We chose to participate in a Eureka project geared solely to applications, especially deep drilling. With our new 800-W YAG, which provides a peak power of 50 kW, we make holes 75-mm deep." Aircraft engine manufacturers find the technique attractive because it eliminates machining: it takes less than three seconds to laser-drill lubrication holes in steel castings 20-mm thick!

Finally, the slab lasers (YAG's with a slab-like resonator bar that improves the optical characteristics of the beam) are experiencing spectacular developments. Lasag, a company of the Swiss watch-making group SMH

unveiled its first low-power laser source for high-precision micromechanical machining, while MLS, until now the only firm in the world capable of achieving industrial expertise in this promising technology, introduced a 1-kW slab laser.

France: Low Temperature Plasma Spraying Surface Treatment Developed

92WS0090B Paris INDUSTRIES ET TECHNIQUES
in French 6 Sep 91 p 63

[Article by Michel Le Toullec: "The All Purpose Plasma System; Surface Treatment"; first paragraph is INDUSTRIES ET TECHNIQUES introduction"]

[Text] This facility will spray wear-resistant, anticorrosion, or heat-resistant coatings, under vacuum or under positive pressure—at temperatures that do not exceed 40°C.

Imagine a facility capable of plasma spraying a variety of materials onto the surface of parts subject to friction, corrosion, high-temperature, or wear.... And to do so either under vacuum, at atmospheric pressure, or even under positive pressure. All this taking place in a confined atmosphere that does not exceed 40°C. Stop imagining such a facility: Plasma Technik France has built it. At its Villefontaine site (near Lyon), this subsidiary of the Swiss Sulzer group has just set up a surface-treatment system it claims is the most complete currently available on the market: the CAPS system (controlled-atmosphere plasma spraying). A system it expects to be marketing by next year.

Gases Are Filtered, Then Recycled To Prevent Emissions

"Initially, the demand for a new plasma-spraying system came from aircraft and aerospace manufacturers and from the military," Jean-Paul Langagne, the Plasma Technik chief executive officer [CEO], told us. "At the time, they wished to improve the characteristics of certain parts made of plastic-matrix composites. Their problem was that traditional vacuum spraying systems precluded the treatment of composite supports because the temperatures reached inside the treatment chamber were far too high. We then designed and patented a system to cool the gases inside the chamber. As a result, the temperature inside the chamber is hardly any higher than in the workshop."

Not only are the gases cooled, they are also filtered and recycled to prevent any pollution inside the chamber, and to make it possible to work successively in different atmospheres. As an example of application, he mentioned the treatment of a combustion chamber in order to improve its high-temperature characteristics: "Without disassembling anything, we can first deposit a first layer under vacuum, which will thus have excellent adhesion; then a second layer, the thermal barrier proper, using a refractory material," he explained.

The system makes it possible to spray materials in air, under vacuum, in an inert-gas atmosphere, or in a reagent-gas atmosphere. And also—an original feature—in a positive-pressure atmosphere, up to 4 bars. The advantage is that the plasmas obtained are markedly denser. "We can thus optimize the fusion of powder particles and even spray materials that decompose at atmospheric pressure." Certain superconducting ferrites and oxides can thus be plasma sprayed for electronics applications. For the treatment of mechanical parts (friction parts, cutting parts), very hard boride, nitride, or carbide deposits are available. And for thermal protection, refractory ceramics are the obvious choice. This type of "thermal barrier" treatment for the military sector (Plasma Technik's second largest market after the aircraft industry) is also likely to provide the system's initial market.

The CAPS currently installed is equipped with a chamber 2.50 meters [m] in diameter and 4-m long. It can treat parts up to 1 m in diameter and 1.80-m long. "But there will be no standard model of the system," Jean-Paul Langagne assured us. "We are currently improving the system by adding a parts-transfer device for the pre-and post-treatment stages. And, of course, the chamber dimensions will be determined based on the customer's requirements." Cost of this all-purpose facility: about 10 million francs.

[Box, p 63]

A Powder-Processing Laboratory

In order to develop and supply specific powders, Plasma Technik France has acquired a dedicated processing and development laboratory. It will develop ceramic, metallic, ceramic-metallic, organometallic, and organoceramic powders. In particular, the laboratory has an air sintering furnace, a granulator-dryer, and an induction-plasma powder-processing machine (IPT process), for which Plasma Technik owns the patent.

France: Advanced Electronic-Component Assembling Robot Developed

92WS0090C Paris INDUSTRIES ET TECHNIQUES
in French 20 Sep 91 p 69

[Article by Ridha Loukil: "Electronics: Fast, Flexible, and Precise Robot"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] It will install 10,000 surface-mounted components per hour. Using two cameras, it achieves a precision of 0.06 mm.

Speed was Eurosoft Robotique priority when it developed its latest robot for the installation of surface-mounted electronic components, the Europlacer 928. Equipped with two heads, each with a four-nozzle magazine, the machine can install components at the rate of 10,000 per hour. Enough to give Eurosoft Robotique

entry on large-volume markets such as consumer electronics, telephony, and the automobile.

Seven Types of Components: Strips, Sticks, or Recessed Trays

Until now, the French specialist of automatic component-placement systems relied on versatility, with installation rates below 5,000 components per hour. By broadening its strategy, it meets the demand of the market not just for versatile machines, but also for increasingly fast machines. The idea that users should choose either versatility or speed is about to lose ground.

In fact, the company does not appear to have sacrificed much versatility on the Europlacer 928. With six types of nozzles, the machine can accept seven types of components packaged in strips, sticks or recessed trays. Certainly, processing such a large variety of components required a few basic changes. But this was offset by the fact that the installation rate of 10,000 components per hour can be maintained even with larger components. Eurosoft Robotique insists that this is the actual installation rate.

Achieving speed is made still easier by the fact that the components magazine, with a 96-pack capacity, is loaded in masked time. Another factor contributing to speed is random loading: the component packs may be mounted in any order. The software enables the machine to identify the type of components in each pack and determine on its own the optimum installation sequence.

The precision of installation is also due to the image-processing software associated to two CCD [charge-coupled devices] cameras. One checks the dimensions of the component and repositions it on the printed circuit. This operation is simultaneously displayed on a screen. The other camera is used for the optical repositioning of the printed circuit. It measures the exact coordinates of the card on the machine. Positioning defects are then offset during the placement of the components. As a result, the installation precision is ± 0.06 mm, with a repeatability of ± 0.01 mm.

France: Automation Software Presented

92WS0085B Paris INDUSTRIES ET TECHNIQUES
in French 20 Sep 91 p 36

[Article by Mirel Scherer: "Software to the Rescue of Control Engineers"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] Software can do anything. From real-time simulation of automation to technical documentation, program testing and even simultaneous engineering. It was all on display at Automation '91 in Paris....

In the world of automation, the goal is to give users machinery that is simpler to use, more efficient, and capable of meeting their needs without a lot of fuss. The Simula and Orelia software applications developed by

3IP Citroen automobiles do just that. The first facilitates modeling and real-time simulation of robot-operated manufacturing tools, and validates robotics programs via testing routines. The second is a technical documentation tool. It manages the data about an automation project and helps develop its specification sheet. Built around a word processor and CAD [computer-assisted design] module, this user-friendly software package even standardizes information queries and tenders for applications, and it processes supplier estimates. Already in use at Citroen, it helps experts prepare specification sheets for new assembly lines and gear-boxes. These tasks involve arduous detail work, which in the past required numerous sketches. With the new software, a specification sheet can be created in two days. Along the same lines, Esia has announced it is marketing software which can assist in decision-making by facilitating queries against complex information systems and preparation of data summaries.

Sequential Regulation

Other companies are following suit, offering utilities that can test an automation program. Such as Automat Service, with its Synopsys testing platform which runs on a PC. Or Spie Batignolles, which has a panoply of software to facilitate the quick installation of an automation system that is reliable and well-adapted to the task. An example: Maxsim, a program to model the operational behavior of a future installation, simulate it, and validate the process controls. Geoide, in collaboration with Elf Aquitaine, came up with K-Sys, a communication tool designed to assist in the development and implementation of industrial projects by linking multiple operators working on the same project. This is a real advantage in a simultaneous engineering environment. Especially since the software allows reutilization of existing systems, maximizing the benefits of standardization.

There are also new robotics concepts on the market, such as combining the control and sequencing functions in the same device. Examples: Telemecanique's PMX-7 and Opto 22's Mystic (distributed by Factory Systemes). In time, the field of applications will become much broader, encompassing industries that manufacture by lots or semicontinuously (microchemistry, pharmaceuticals, metal- and glass-work, agro-food), those engaged in continuous-process manufacturing, and even industries that use regulators (in the baking of automobile lacquers, for example).

Software workshops for control engineers are also growing apace. The Alogaf system, an offshoot of a project put together by Philips and EMR, provides control engineers the resources they need to design applications in a "multigraf-cets" translation unknown structure for real-time processors linked to a VME [prob. Virtual Machine Environment] bus. The latter, which has been adopted by several manufacturers (the April 7000 automaton, for example, relies on a VME bus), offers a satisfactory solution for applications that require

a great deal of processing capacity and memory, along with rapid acquisition and processing.

France: Fuzzy-Logic Numerical Control Improves Machine Tool Performance

92WS0083C Paris INDUSTRIES ET TECHNIQUES
in French 20 Sep 91 p 18

[Article by Mirel Scherer: "Num Is Fuzzy About Numerical Control: To Simplify the Operator's Life"]

[Text] After unveiling the performance of its latest arrival, the 32-bit numerical control Num 1060, the French manufacturer Num is looking for other approaches to technology improvement through the use of fuzzy logic. As explained by Michel Allain, Num project leader: "The implementation devices for numerical control on various machine tools are currently extremely complex."

The axis control algorithms integrated into numerical control for instance, are sophisticated and involve a very large number of parameters. But the technicians who install numerical control equipment at machine tool manufacturers, do not have this expertise, which often requires an advanced level of programming engineering. And while some parameters are readily identifiable by performing a measurement on the machine tool, others remain very difficult to grasp: These are parameters associated with the job, which can be determined only "by feel." And here is where fuzzy logic comes in, an information processing technique capable of taking imprecise data into account. "This will provide the installers with the knowledge they need to rapidly adapt numerical control to the machines."

The project team has benefitted from the fuzzy logic knowledge acquired by Telemecanique specialists, to integrate this technology into its automation components (comparable to the work of the Japanese manufacturer Omron). Num's project, whose feasibility has been demonstrated and the tools for which have been gathered, is currently moving through a second stage, the most difficult one: its practical implementation. At the next machine tool biennial, in June, we'll see if the offspring has reached full term.

Renault's Problems With Just-in-Time Manufacturing Discussed

92WS0095A Paris TECHNIQUES ET
EQUIPEMENTS DE PRODUCTION in French Sep 91
p 16

[Article by L.V.: "Just-in-Time: Preconditions for Implementation"; first paragraph is TECHNIQUES ET EQUIPEMENTS DE PRODUCTION introduction]

[Text] Just-in-time (JAT) alone is no panacea. A study made at Renault shows that full effectiveness requires prior analysis of the system, anticipation of problems, and new management tools...

With just-in-time, you have to make haste slowly. This is what came out of a study of JAT implementation made by Renault, with support from the Ministry of Research and Technology (MRT). Also collaborating in the project were the National Agency for Improvement of Working Conditions (ANACT), the Paris Mining School, and the Research Group on Working Conditions. The study focused on analysis of the transmission drive-shaft workshop at the Cleon plant when it went on line in summer 1989. This study, conducted with some sense of urgency, was motivated by the need to free up space in the factory to accommodate other production.

Several different kinds of problems were encountered in the move to JAT. The radical transformation of flow management presented unexpected problems, owing to the juxtaposition of machines which in the past had operated independently of each other. Aspects of the problem included difficulties with transfer of parts, delays and snags when tools were replaced, and occasional unreliability. With several different products being machined on the same production line, interference and flow surges disrupted the envisioned performance of the system. In the face of all these complications, there was a tendency to return to stocking of supplies. Equipment operators, cut off from the stocks which had allowed them to adjust the work flow, had lost their margin of maneuver. "No one had thought about that aspect beforehand," says one of the people involved.

Human resource management is a big priority. But at Cleon the transition may have been made too quickly for the personnel. The old system had some features they appreciated. Those features do not necessarily have to be kept, but they must be taken into account during the transition. According to one observer, "the human factor could have been integrated more easily if thought had been given in advance." Initially, operators were "destabilized": Some felt a loss of professional self-worth. "We are asking people not only to become multifunctional but also to assume the role of flow managers, to be able to react, to take decisions in response to the unexpected," one researcher emphasizes. So the operator must have some mental picture of the system. But the way in which work is organized should not be a mere "by-product of the way production is organized." It is probably preferable to change the two in tandem and shift gradually into JAT.

Tasks Redistributed

The time factor is critical. Unless enough time is devoted to the preparation phase, there is a high risk that functional modes characteristic of the old production system will reappear. JAT production systems are very fragile: Continuous-flow decompartmentalizes problems, so the slightest incident can paralyze the entire system at any moment.

Three broad categories of recommendations have emerged. In the first place, "a more comprehensive

diagnostic of the starting situation [is needed], a diagnostic that goes beyond just the machinery." One researcher points out that "one of the main problems with implementing JAT is the disconnect between the real situation and the theoretical model." All parameters that influence performance, working conditions and system operations must be evaluated. Organizational disruption, including the redistribution of tasks between supervisors and equipment operators, must be taken into account. "Today, we have a situation where operators handle some of the supervisory tasks. There is greater delegation of technical control and management," one observer notes.

In the second place, it is necessary to anticipate dysfunctions and adaptation strategies. The manner in which machinery will be integrated into the production line must be anticipated both from the technical and the ergonomic point of view. Factors such as increased noise or heat levels can have an effect.

In the third place, the need for better management tools is making itself felt.

"They must also ensure that operators understand the production system and its limitations," says one researcher. And performance must be judged not only on production volume but also on success in meeting new objectives of customer satisfaction in terms of quantity, quality and response time.

LASERS, SENSORS, OPTICS

French Firm Develops All-Optical Earphone

92AN0047 Paris *ELECTRONIQUE INTERNATIONALE*
HEBDO in French 24 Oct 91 p 26

[Article signed F.L.: "Silec Creates Sound With Light"]

[Text] The direct transformation (without energetic or electronic input) of light into acoustic energy is indeed possible. Silec has just proved this with its all-optical earphone.

The role of light in electronics has not yet come to an end. It could even make inroads into the acoustics sector. The development of an earphone capable of producing sound from an optical signal without power or electronic input, in other words all-optical, is indeed no longer a pipe dream nowadays. Silec, a subsidiary of Sagem, whose reputation is founded on, among other things, its self-generating high-security communications equipment, has worked on the process and has come up with a prototype for an all-optical earphone. This is a world's first, according to Silec. And, parallel to this, the firm is working on the design of an all-optical microphone—a sensor which will transform sound into an optical signal without resorting to any kind of electrical conversion. The French manufacturer intends being able to present a comprehensive all-optical earphone-microphone system within the next 6 months.

Optical Thermoacoustic Conversion

For the time being, the Sagem subsidiary is rather secretive about the technology of its optical earphone. "The system is so simple," explained Mr Housni, who developed it. The only hints: The process on which it is based is an optical thermoacoustic conversion. The change of temperature induced by an optical signal transmitted by a fiber-optic carrier results in a vibration of the air. The sound is produced through an acoustic tube with a diameter of 1 mm or less. The system uses no membrane and can further be miniaturized while remaining sufficiently efficient to consider industrial applications. The sound level obtained is currently 80 dB (sound level of the telephone) in a volume equivalent to that of an ear drum. Indeed, the conversion efficiency of the opto-thermic process is between 15 and 20 percent. The passband of the optical earphone corresponds to that of a standard telephone, in other words, 300 to 3,400 Hz.

After initial examination, Silec has already found several potential outlets for its earphone-microphone system. The advantages of "all-optical" equipment are well known: insensitiveness to electro-magnetic interferences, absolute secrecy of information, use in explosive environments. The first application involves the development of a railway-side communications system (for network maintenance). This is an application where electrical interferences are very strong and where traditional telephone equipment has to be shielded. According to Silec, this makes the telephone sufficiently expensive to give optical equipment a chance of making its mark, despite the high prices of laser diodes (with power levels above 100 mW).

Another possible field of application is noise control systems. In other words, the development of an active noise control system based on the elimination of noise returning its inverted signal.

In this application, the advantage of the Silec solution over conventional membrane-based speakers does not lie in its all-optical aspect, but in its miniaturization level. Because, as Silec stresses, in this type of antinoise system, one of the main difficulties consists in returning the inverse noise signal at the exact point where the noise was recorded by the sensor-microphone. It is therefore of utmost importance to have the smallest possible earphone to achieve an immediate sensor and activator system.

France: Sextant Avionique, Sagem Develop Gyrolasers

92WS0077A Paris INDUSTRIES ET TECHNIQUES
in French 4 Oct 91 pp 6, 7

[Article: "Turn, Lasers!"]

[Text] Laser will cut, weld, drill, measure. From now on, it will also take care of aircraft navigation. Laser gyros, or gyrolasers, are making their industrial debut. In

France, Sextant Avionique and Sagem [Company for General Applications of Electricity and Mechanics] have perfected laser solutions that took 10 years or so to develop. These units are lighter, more compact, and less expensive than the traditional mechanical platforms. Allying precision mechanics and optronics, their manufacture requires highly specialized production means. For the time being, gyrolasers are mounted on certain versions of Ariane 4 and on the Transall aircraft. Soon, they will equip the French-German Tiger combat helicopter and the Ariane 5 rocket.

The operating principle of a gyrolaser is actually rather simple. Two light waves turn in opposite directions in a single sealed cavity. Mirrors mounted at the three vertices of the triangle reflect the rays which, therefore, go round in a closed circuit. Using one mobile mirror, the length of the optical paths is adjusted so that the path of the rays covers an integral number of wavelengths. Rotating the case around an axis perpendicular to the plane of the rays will induce a difference in the time it takes for the laser rays to cover their respective paths (Doppler effect). Measuring this infinitesimal time differential makes it possible to determine the direction of motion. Three gyrolasers mounted on the three axes are required to know the position of a mobile in space.

There is no problem with helium-neon laser sources: they are available commercially. But that is not the case as far as machining the optical cavity and the mirrors and assembling the unit are concerned. These three operations demand precision and cleanliness levels worthy of the electronics industry; therefore, Sextant set up a dedicated workshop at its Chatellerault plant. The cavity is machined in a bloc of vitroceraic (Zerodur). The central area of the mirrors are treated to a surface polish of one tenth of the laser wavelength, i.e., about 0.6 micron. Thanks to this surface polish, the adhesion of the mirrors to the cavities is achieved by mere molecular attraction. The mirrors also receive an optical surface coating of some 20 layers.

The simplest gyrolaser consists of a single triangular optical cavity, the perimeter of which measures 33 cm. A complete navigation system will therefore include three independent blocks mounted in each of the three planes. This is the solution adopted for Ariane 4. The highest degree of sophistication is achieved with gyrolasers having three integrated axes. In this case, the three cavities are machined in a single block of Zerodur and interpenetrate one another. The device is coupled to three accelerometers (which measure the speed) and to control electronics. A gyrolaser of this new generation (Pixyz) was selected for the Tiger helicopter. Sextant Avionique expects to produce eventually a few hundreds of gyrolasers per year.

Eastern German Laser R&D Reorganized

92MI0067 Stuttgart LASER UND
OPTOELEKTRONIK in German Oct 91 p 16

[Text] The recommendations on the former [GDR] Academy of Sciences institutes engaged primarily in

laser research and laser engineering have now been submitted and will be implemented as soon as possible.

The furthest advanced are the plans of the Fraunhofer Society (FhG), which will take over, as a full-fledged institute, the division of the Dresden-based Central Institute of Solid-State Physics and Materials Research (ZFW) that works on laser applications. The FhG envisages an initial staff of 56, starting in 1992, for this Fraunhofer Institute of Materials Physics and Coating Technology, which is currently being founded.

The laser demonstration center, which opened on 7 June, will be a part of the Fraunhofer Institute of Materials Physics and Coating Technology. One of its primary tasks is to support small and medium-sized enterprises in introducing laser engineering as a key technology for such important applications as mechanical engineering, production engineering, and medicine.

The Science Council has also recommended setting up an Institute of Nonlinear Optics and Short-Time Spectroscopy in Berlin to expand laser research in the new laender. This institute will become a blue chip establishment. It is being created out of part of the Central Institute of Optics and Spectroscopy (ZOS). Responsibility and funding for these two institutes in Dresden and Berlin will be shared by the Federal Government and the laender. Further smaller nonuniversity research centers and teams in Jena and Halle and laser research facilities in various universities would then complete the laser research scene in the new laender.

MICROELECTRONICS

EC: ESPRIT Microprocessor Program Launched
92WS0083B Paris INDUSTRIES ET TECHNIQUES
in French 20 Sep 91 p 14

[Article by Ridha Loukil: "Microprocessors: Europe Wakes Up"]

[Text] Faced with the American microprocessor monopoly, the European Community has finally reacted. Brussels has given a green light to the OMI (Open Microprocessor Systems Initiative) R&D project, aimed at reinforcing Europe's potential in this field. A first call for bids has just been launched as part of the third phase of the EC ESPRIT [European Strategic Program for Research and Development in Information Technologies] program, covering the 1991-1995 period.

The manufacturers who initiated this project, Bull, SGS-Thomson, and Olivetti, together with AEG, Alcatel, Philips, and Thomson-CSF, persuaded the EC of the strategic importance of the microprocessors. These chips, which form the brains of computer equipment, are

scattered throughout the industry, providing the products into which they are integrated with the "intelligence" of computers. They consequently create a powerful innovative force in all sectors; but presently, nearly 90 percent of the microprocessors used in Europe are of American origin.

Europe does not pretend to mount a frontal attack against this monopoly: it has neither the means, nor the computer industry needed to support such an effort. "It is not a matter of starting from zero with the idea of creating a new operating system as a sort of European standard," explains Georges Grunberg, Bull deputy director. "We are seeking a more realistic objective, the development of equipment-software integrated solutions compatible with existing standards."

The manufacturers are thus keeping their feet on the ground. The Japanese experience has been a good lesson: with its Tron program, Japan launched into a new chip architecture with a new operating system. Without success so far, despite the fact that Japan controls one-quarter of the world's computer production.

Europe is betting on the know-how accumulated by Inmos, SGS-Thomson subsidiary, and Acorn, an Olivetti subsidiary, with their respective 32-bit microprocessors, the Transputer, and ARM. The OMI project will serve as framework for the development of the next generation, the 64-bit chip. It will also benefit from the experience of American-licensed Europeans such as Siemens, which manufactures the chips for the company Mips, or Philips, which manufactures those of Sun. The objective in this instance is to consolidate Europe's expertise by improving the performance of these chips. Eventually, Europe will have formed a crucible of talent capable of achieving a technical breakthrough, for instance by inventing a new chip architecture, faster but still compatible with existing standards.

The project is of interest for component manufacturers, software writers, and users. The magnitude of the software aspect suggests a strong participation from PME-PMI (small and medium-sized enterprises and industries). It covers three technologies: microcontrollers, low-end circuits used in high-volume applications (automobile, consumer electronics); microprocessors for computer applications (PC, workstations); and parallel computer systems.

The present call for bids focuses on these technologies, with a budget of 65 million European currency units (450 million francs). Another, more significant call for bids is planned for the applications sector.

Eastern German Firm Becomes Sole European Gallium Arsenide Producer

92WS0030B Duesseldorf VDI NACHRICHTEN
in German 6 Sep 91 p 4

[Article by Richard Sietmann: "Gallium Arsenide From Freiberg Is to Save German Market Share: Searching for a Strategy Against Japanese Dumping"]

[Text] Until now, reorganization help for the eastern German economy came from the west. However, this is just the reverse in one future-oriented market of strategic importance. One company in Saxony is preparing to defy the Japanese competition for GaAs substrates now that Federal German companies have dropped out of the race.

The Freiburger Elektronik-Werkstoffe GmbH (FEW) is the legal successor to the former VEB Spurenelemente Freiberg. As such, it is a wholly owned subsidiary of the Trust Agency and now has no competition. The company is the only European firm that can still supply semiinsulating gallium arsenide (GaAs). This semiconductor compound serves as the substrate material for special tasks in UHF (ultrahigh frequency) digital electronics and optoelectronics.

The company from Freiberg achieved this status because of the surprising withdrawal of Wacker-Chemitronic, the leader on the world market. Wacker no longer felt it was possible to subsidize GaAs substrate production from its silicon business. Japanese companies, primarily Sumitomo, offered the wafers on the European market up to 40 percent cheaper. This is purposeful dumping as those who know the market suspect. However, it is difficult to prove.

The far eastern manufacturers—beside Sumitomo, primarily Dowa and Hitachi—have the prerequisites for this in any case. In these companies, wafer production is vertically integrated into the company structure. They can subsidize the preceding stages of value creation from the sales of corresponding components. Using this strategy, they now appear to have attained the preeminent position in the wafer market. American and European component manufacturers are becoming more and more uncomfortable with the prospect of having to purchase the substrates in future from the competition. This also would mean they would become dependent on the prices and delivery conditions of the competition.

As Wacker-Chemitronic does not produce GaAs components, it must achieve all profits in the wafer business. Therefore, it does not have the flexibility of strategically using a vertical pricing policy to counter the Japanese challenge. In this respect, FEW is in no better position. The attempt to continue GaAs wafer production in Freiberg, a mountain city with a rich tradition, is already the third start to save whatever know-how can be saved and to keep one foot in the door of this highly sensitive market.

The first start took place in autumn of last year. Wacker initially held discussions with the Preussag Pure Metals (PPM), a subsidiary of Metaleurope, about the sale of GaAs activities. The plan, finished at the end of February, foresaw 4 inch wafer production continuing at the PPM plant in Langelshiem near Goslar.

However, it did not get that far. As the story goes, PPM wanted to have some of the costs for the physical plant and know-how of Wacker financed as a loan. The loan

would not be payable until the production started showing a profit. In this way, Wacker would have gone from a producer to a reinsurer. While Jochen Riecke, managing director of PPM, will not confirm this scenario due to the agreed confidentiality of the discussions, the deal fell through.

Business politics is now pointing in the other direction. "We have decided to withdraw completely from this area," explains the managing director of PPM. While he does not wish to confirm the numbers, according to an examination, PPM must now write-off more than 10 million German marks in real investments. The impending dependence of European component manufacturers on Japanese vendors was obviously not important enough. "We cannot allow national economics arguments to affect our decisions," says Riecke. "That must come from those agencies charged with national economics."

Now, the Trust Agency has the problem of assuring the GaAs material basis for the German semiconductor industry so the portion of the world market held by Wacker-Chemitronic is not lost. FEW in Freiberg is to take over the know-how and physical plant from Wacker. The chances of achieving a foothold in the world market are good. Based on contacts with concerned American consumers, Hans Glowatzky, managing director of FEW, knows there is very high interest in "continuing to obtain the product provided by Wacker with the same quality."

Now, the time factor is playing a decisive role. With an eye toward the closing of Wacker production, completed at the end of March, all consumers covered their requirements for wafers in a timely manner and filled their warehouses. Because of this, there is still some breathing space. However, according to Hans Glowatzky, "All parties involved know that we can only keep the market share when we close the gate in this year and are positively there with the material at the end of the year."

Siemens Produces Hundreth-Millionth 1-Megabit DRAM

*92WS0130B Berlin MIKROPROZESSORTECHNIK
in German Oct 91 p 47*

[Text] On 28 April at 12:44 PM the hundreth-millionth 1-megabit DRAM (Dynamic Random Access Memory) left the silicon wafer plant at Siemens AG in Regensburg.

Not quite 3 and ½ years after starting production at the end of 1987, the plant has thus worked its way to the uppermost rank of European chip factories. The 1-Mbit memory, at present manufactured in the third shrink version, is as large as 38 mm²; it provides access times as short as 60 ns, and anyone who is intent on saving power can also get it in a low-power version with only 1.65 mW power consumption in the quiescent state.

European Advanced Networking Test Center Opens in Berlin

92MI0137 Munich MARKT & TECHNIK in German
15 Nov 91 p 8

[Text] For the first time, Europe has the capability for using the FDDI [Fiber Distributed Data Interface] standard to test network components for compatability under the corresponding ANSI [American National Standards Institute] standard and for interoperability. European developers can now apply to the newly opened European Advanced Networking Test Center (EANTC) at the Berlin Technical University.

The initiator of the EANTC is semiconductor manufacturer Advanced Micro Devices (AMD), which last year founded the Advanced Networking Test Center in California. Since then about 40 manufacturers and developers of FDDI system components have been jointly testing their products there for interoperability. The ANTC operators have agreed on a standardized set of FDDI tests, because the standardization committees have so far failed to define any generally accepted interoperability tests. This wealth of experience is now available to European enterprises too, making expensive trips to the ANTC unnecessary, although final inspection must still take place in California.

"Opening the EANTC has brought us a step nearer to our objective of making the FDDI test suite available worldwide," said Jochen Polster, AMD's European Marketing Manager for network components, at the opening of the new test center, stressing again that the facility was open to FDDI suppliers of every kind, whether they make chips or systems.

Dr. Klaus Rebensburg of the Berlin Technical University explained that non-EANTC members have to pay 12,000 German marks [DM] for a test series. After signing the contract, the firm concerned has one year in which to have the test carried out.

During interoperability testing, the devices concerned are operated together with several FDDI products from other manufacturers.

The EANTC comprises a "secure room," in which an individual manufacturer can conduct his tests confidentially, and a "group testing room" where up to six partners can carry out FDDI interoperability and performance tests jointly. Both test rooms provide access to the Berlin Technical University's "TUBKOM" test bed, which offers other network technologies such as Ethernet, ISDN [integrated services digital network] and broadband ISDN with transmission rates up to 140 MBit/s. The test environment includes an FDDI ring in which workstations by various manufacturers are accessible for research purposes.

ANTC members worldwide include firms such as 3Com, BICC, Fujitsu, Hewlett-Packard, IBM, Proteon, Schneider & Koch, Sun Microsystems and Ungermann-Bass.

Germany: Microsystems Engineering Fair Reviewed

92MI0077 Duesseldorf HANDELSBLATT in German
31 Oct 91 p 24

[Text] High performance in a small space: Microsystems engineering makes it possible to develop intelligent products that can collect and evaluate data independently, and perform actions on the basis of this data. The second international "Microsystem Technologies 91" congress and technical trade fair continues until tomorrow in Berlin and has the first prototypes of micromotors and sensor systems on exhibit.

Experts expect microsystems engineering, the world market for which will grow during the next few years from 18 to 75 billion German marks [DM] according to estimates by the Stanford Research Institute, to revolutionize the entire development of electronics. The future prospect of accommodating all sensor, actuator, and memory components on a single chip leads scientists to envisage gigantic increases in performance.

"We hope to integrate mechanical, electrical, thermal, logical, optical, and biological functions on a single chip," explained Professor Herbert Reichl of the Technical University of Berlin at the opening press conference. He added that microsystem structures were the same size as biological structures, thus making it possible to apply biological principles to the world of technology.

He went on to say that scientists and specialists from industry would need to work together on an interdisciplinary basis to solve developmental problems; compared with microelectronics, microsystems engineering covers a wide range of materials, (metals, semiconductors, ceramics, polymers) and processes (semiconductor technology, thick- and thin-film technologies, microelectroplating, and plasma and laser technologies). It requires simulation and design systems for linked mechanical, electrical, thermal, and optical field problems. Differing energy conversion principles have to be pursued, and an understanding of the interactions between technical and biological systems is necessary.

The Battelle Institute in Frankfurt has presented its preliminary findings from its current worldwide technology study of a sub-area of microsystems engineering, micromechanics, at the Berlin fair. Market researchers expect a rapid growth in micromechanical components to follow, such as jets, lattices, channels, and membranes, and they anticipate similar growth in sensors. Other major component developments include actuators (relays, switches, valves, micropumps, and thermal printheads), and microsystems (miniaturized analysis systems, flow control systems, micromotors).

Unexpected Strength of Swiss and Dutch Firms

More than 300 firms and institutes throughout the world are currently working on the development of new micro-mechanical components, most of them located in the United States, followed by Japan and Germany. Dr.

Guido Tschulena, who heads the Battelle project, identifies remarkable strengths in the small European countries of Switzerland and the Netherlands, where "a crucial factor is the interaction between experience with more traditional high-precision mechanics and the experience of mass-producing semiconductor components."

According to the Battelle Institute, micromechanics has applications potential in a wide range of sectors, the time factor being crucial in bringing micromechanical components onto the market. They expect imminent applications in process and medical engineering and in automobile electronics, with communications, aerospace, consumer electronics, and mechanical engineering to follow.

Exhibitors at the Berlin fair are offering a taste of future products that microsystems engineering experts expect to be mass-producible within the next few years. One example being presented is an intelligent heart catheter developed by the Fraunhofer Institute of Microelectronic Circuits and Systems (IMS) in Duisburg for the continuous monitoring of blood parameters without regular samples being taken from the patient.

The doctor reads the value measured on the VDU screen and if necessary can rapidly administer any drugs required by the same catheter. This microsystem combines on one chip the sensors that convert the blood parameters into electrical signals with the evaluation electronics. Proven microelectronic production techniques make it possible to produce such systems in dimensions of 1 x 5 mm, and mass production methods have reduced unit costs by around a factor of 10. The instrument is presently undergoing animal testing and is soon to be used in intensive care.

An offline miniaturized impact and temperature data recording terminal developed by SMT & Hybrid of Dresden has a wide range of possible uses, for example in monitoring the transport of delicate goods. A 160 x 80 x 55 mm casing contains three acceleration sensors, a temperature probe, a microcomputer, and a battery.

It records mechanical impacts in any direction with 20-g precision and when a freely programmable threshold value is exceeded, an impact and its date, time, peak value, and duration are recorded and stored. The temperature is stored periodically. An example of a basic technology component is a micro-epicyclic gear for miniaturized motors in CD players, cameras, or measuring instruments, presented by MicroParts of Karlsruhe; the external diameter of the gear measures 2.8 mm.

Rudolph Krahn, of the VDI/VDE [Association of German Engineers/Association of German Electrical Engineers] Information Technology Center in Berlin (the project leader for the DM400 million "microsystems engineering" program launched last year by the Federal Ministry of Research and Technology (BMFT) sees good competitive prospects for medium-sized firms, "though the opportunities must be grasped now." He says that there is still a lot of work to be done on microsystems

engineering, both for universities and institutes and for corporate research and development departments. Mere enthusiasm for a novel technology with virtually unlimited potential is not sufficient as a driving force in research; priority must be given to meeting practical needs.

TELECOMMUNICATIONS

Matra, Telefunken Develop Single-Chip Telephone

92AN0045 Paris *ELECTRONIQUE INTERNATIONALE*
HEBDO in French 24 Oct 91 p 16

[Article by Elisabeth Feder: "Middle-of-the-Range Telephone Fits on Single Chip"]

[Text] The solution put forward by Telefunken combines all basic analog and digital functions on a single chip.

Single integrated-circuit telephones are becoming economically feasible. The German company Telefunken, in cooperation with Matra Communication, which commissioned the development, has integrated all basic functions of a middle-of-the-range telephone, including the transmission, reception, generation of the dial tone, dialing and redialing functions, and keypad and line interface, on to a single monolithic component. The available technology used, in this instance bipolar complementary metal-oxide semiconductor (BiCMOS), enabled the least expensive production techniques to be considered. By authorizing Telefunken to put the circuit on the market right away, which required a certain flexibility at the design level, Matra itself should benefit from mass production, and therefore lower prices. Production should start in November. The circuit, reference UB3750BM, is currently being appraised by several manufacturers and Telefunken expects huge orders to the tune of 1 million units per year in the short term.

According to Henrik Gutsch, Telefunken's manager for telecommunications IC development, there is no competition on the market for this component. Today's solutions are not available in BiCMOS on the one hand and require several external components on the other. The UB3750BM itself only has a few passive components in a single telephone.

Telefunken possessed the BiCMOS technology which enabled it to integrate, in the best possible way, the different control functions required while guaranteeing frequency stability, high power, as well as a low noise level associated with a high integration density. The main characteristics of this technology, developed using 2.5-micron CMOS process, include a 2-GHz transition frequency under a 120-V voltage for npn bipolar transistors and a drain-to-source turn-on voltage of 60 V for metal-oxide semiconductor (MOS) transistors.

In collaboration with its partner Matra Communication, Telefunken opted for development specifications that

corresponded to the functions of a middle-of-the-range telephone with a good cost/efficiency ratio, and with particular regard for systems costs. Therefore, the integrated functions essentially comprise: At the transmission end: signal amplification (48 dB, adjustable) adapted to the length of the line; at the reception end: line signal amplification (11 dB, adjustable) for the receiver; acoustic signal generation for incoming calls; dial pulse signal generation either by consecutive pulses or by a combination of frequencies; redialing of numbers when unsuccessful; as well as keypad and line interface.

The two analog and digital parts which make up the UB3750BM are respectively designed using bipolar and CMOS components.

Programmable According to P&T Specifications

The circuit as a whole comprises 800 bipolar transistors and 20,000 MOS transistors. The analog zone encompasses the controls for transmission, reception, and generation of power supply for the different functional blocks.

A low-noise preamplifier generates the microphone signal and sends it with the dial pulse signal to a second amplification level which also carries out line matching. An external network defines the circuit impedance, which explains a greater flexibility of use in relation to the specifications required by the different P&T administrations.

For these same reasons, an intelligent mix of fixed and programmable functions was chosen for the analog part. The entire system's logic is controlled by a 5-bit microprocessor, a data bus of this size being sufficient for the coding of dialing codes and different instructions. The ring control is an independent function; it transforms the 25-Hz incoming call into a high-frequency signal.

To achieve this, the limits of BiCMOS technology were exploited, notably with high-voltage transistors in a push-pull output level to guarantee frequency stability.

Status of German Telecommunications Reviewed

92MI0061 Duesseldorf *HANDELSBLATT* in German
25-26 Oct p 25

[Article by Rolf W. Goering: "What Telecommunications Should Be Achieving in Germany"]

[Text] "The year of change, the year of new departures": This was how DBP [Deutsche Bundespost] Telekom triumphantly headed its first annual report, which recounts the successes of 1990: Nevertheless, other views could be heard at a conference of various associations: for example, that its charges were the highest in the world; that broadband availability was too narrow: that Germany was lagging 16 years behind the U.S.; that competitive pressures posed a threat; that research was

losing status internationally; and that, even in the area of speech communication, deregulation was urgently needed.

The AGF (Association of Major Research Establishments), the (BDI Confederation of German Industry), and the DFN (German Research Network) Association were the hosts at the state of telecommunications in Germany. Professor Dr. Gerhard Seegmueller of the AGF said that, as modern industrial society depended on the rapid exchange of information and data, broadband communications had become a political issue in the U.S., in contrast to Germany. He estimated that the Federal Republic would take 15 years to catch up with the U.S.

Dr. Carsten Kreklau stressed that the BDI also viewed telecommunications as a key function whose importance in the coming decades would exceed even that of the automobile industry. He stated that communications had traditionally been a rigid sector in Germany. It was becoming increasingly dependent on component manufacturers, who were frequently not located in the Federal Republic, or even in the EC. Telecommunications, he said, had become a siting factor, and without adequate provision Germany would become a second choice location.

Generally, participants felt that postal reform had been only a half-measure; deregulation should have been taken further and extended to the telephone and network services. Professor Witte, who had chaired the commission, stated that, when the recommendations to the Federal Minister of Posts had been drafted, the votes were evenly divided for and against full deregulation. In the end, a political decision had been taken.

Carl-Friedrich Meissner, a board member at Telekom's head office in Bonn, cited an example illustrating the present situation: He described the attitude of a Bundestag deputy who had declared himself in favor of complete deregulation (abolition of the monopoly), provided that telephone charges in his constituency did not rise above 0.25 German marks.

The great importance of telecommunications was described by DFN Association chairman Professor Dieter Haupt. The association's aim, he said, was to ensure that computer-assisted communication at affordable prices was available to all its members in research and teaching, who currently numbered 230. The Telekom-operated network enables the total computer capacity available in the major research facilities to be linked up as a single computer, and makes it possible for interregional research teams to be created.

Criticism of High Data Transmission Charges

The transmission bandwidths for such projects are in the 34 Mbit/s to 500 Mbit/s range. The DFN feels however that the charges for the 2 Mbit/s network currently available are only justified for 100 Mbit/s lines and that, compared with those in the United States and Japan,

scientists are at a considerable disadvantage as far as experimenting with transmission and switching methods and distributed systems is concerned.

Telekom's excessive costs were also putting industrial users at a competitive disadvantage, complained Klaus Schulz from Volkswagen AG in Wolfsburg: The 2-Mbit/s output charge was 20 times higher in Germany than for 5 Mbit/s in the United States, he said.

The harsh criticism from participants placed Carl-Friedrich Meissner, Telekom's representative at the conference, in a difficult position. The euphoria over the successes of the company's first year after the Postal Structure Law of 1 July 1989 had entered into force had hardly prepared him for such attacks. He did point out, however, that Telekom was ultimately a federal authority rather than an independent company; it was owned by the Federal Government, to whom requests should be addressed. The current scale of charges, he said, dated from 1988, though the supervisory board had drawn up a new package of charges that were pending adoption.

Basically, charge rates needed to be reversed, he stated: Local calls were too cheap, and trunk charges were too expensive. Furthermore, as a public service Telekom was not in a position to act like an independent company. Telekom was planning a network with a monopoly on variable transmission speeds ranging from 9.6 Kbit/s to 2 Mbit/s; higher transmission speeds would not be covered by the monopoly. In considering Telekom's achievements, due account should also be taken of reliability and quality, felt Meissner.

Meissner estimates the annual growth in data traffic at 20 percent and in speech transmission at 8 percent. ISDN (integrated services digital network) takes on greater importance from 1995, though broadband ISDN would take until the year 2000. Meissner sees future prospects in office communications which provides network services for facilities ranging from the individual PC workstation to office centers; a partner is still being sought.

The papers revealed that Telekom too, is still in a state of flux. The long years of monopoly concealed many problems. Decision-making was shared between "the Post Office and Siemens," so no market had yet developed, complained Colonia Insurance AG board member

Friedrich K. Rauch. Thinking in communications technology had been frozen, with the result that only standard solutions were applied; lack of competition had resulted in a lack of new services.

He outlined a speech communication system that was being developed in conjunction with broadband communications; it would make insurance companies more attractive and be customer-operated. This very well-received address illustrated the necessity of overcoming the barriers in speech communication as well.

Philips Builds Dutch Passive Optic Network

92MI0062 Stuttgart LASER UND

OPTOELEKTRONIK in German Oct 91 p 13

[Text] The Dutch PTT [Post, Telegraph, and Telecommunications administrations] has brought a pilot project entitled "Fiber to the Home" into service in the newly developed area of Sloten in Amsterdam. Philips has connected 200 households to the head end located in the telephone exchange via eight passive optical networks. The subscribers are now receiving a telecommunications service, television, and radio programmes via a glass fiber. With this field trial, Philips has set up a glass fiber network that can be installed and operated efficiently within existing services, such as telephone and TV/radio. Moreover, the glass fiber infrastructure is designed in such a way that it will be able to transmit services that become available in the future.

All signals are fed into the single mode fiber by the head end, which is located in the local telecommunications exchange.

Optical directional couplers made for economic use of a single fiber for both directions with only one common wavelength (1300 nm window).

Television and radio programmes are transmitted to all subscribers on a second wavelength (1500 nm [nautical mile] window), again over the same glass fiber network. The use of FM technology for this service offers a high passive distribution factor (power budget). This shares the costs of the head end (DFB [distributed feedback] laser transmitter) among several subscribers.

A highly developed network management system provides simultaneous configuration and error control of all eight networks. Subscriber installations can be disconnected, new network terminations can be connected, and channel capacities can be allocated during operation via a user-friendly menu in the management system.

COMPUTERS

Hungary: Two Companies Present Latest Products at COMPAIR '91

Muszertechnika

92WS0109A Budapest *COMPUTERWORLD/*
SZAMITASTECHNIKA in Hungarian 10 Oct 91 p 2

[Article by S. M.: "Muszertechnika, Prospects"]

[Text] "Naturally we will receive the visitors with the computer technology offering customary from our firm," said Zsolt Szilagyi, marketing manager of the Muszertechnika [Instrument Technology] Company, when we asked him about the products of the company appearing at Compair '91. The members of the MT family, the Siemens computers and peripherals, and the Fujitsu printers will make the list of computer equipment complete.

Computerized data transmission is one of the key words at this year's exhibit at pavilion 33. A working network in close cooperation with 3COM will illustrate that the company is prepared to install this sort of system.

One of the children born of the marriage of Muszertechnika and Ericsson is the large AXE digital telephone exchange manufactured by the company; its presence will illustrate that the firm is striving for a serious market share in the area of telecommunications as well. This equipment will be the basic pillar of the telephone exchanges to be installed or renovated by MATAV [Hungarian Telecommunications Enterprise] in the near future.

"True, for the time being, it will be shown only in the beta version. but at our stand one will be able to see a completely Hungarianized version of WordPerfect, one of the largest selling text editors in the world," Mr. Szilagyi said. He is also chief of distribution of the program in Hungary. The "Hungarian" WordPerfect 5.1 will surely be on the market in a few months.

Controll

92WS0109B Budapest *COMPUTERWORLD/*
SZAMITASTECHNIKA in Hungarian 10 Oct 91 p 2

[Article by Peter Sz.-Szalay: "Festive Display"]

[Text] Controll is 10 years old. They are recalling this at stand 202/a of the "A" pavilion, and are preparing for the exhibition in this spirit.

"What might we see at the anniversary exhibit?" we asked marketing director Andras Kolesar.

"Naturally lots of computer technology, because this is our chief profile even today, but in addition we will be offering modern telecommunications and office technology. Our assortment has expanded—and changed—

significantly in a decade, but a common characteristic is permanent: quality. We have not made and will not make concessions in this.

"We also recognized that the future belongs to open systems, and this shows strikingly in our offering. We have adjusted to the UNIX based standards and in this spirit signed distributor's contracts with Proteon, Allied Telesis, and Fibronics. Within the framework of the agreement we offer our customers Token-Ring and Ethernet local networks and glass fiber technology.

"It is already well known that we have founded a joint enterprise with Hewlett-Packard. The HP&C will offer the units of the HP 9000 series, and we are expanding our PC offering with the HP Vectra 386 and 486 models and their peripherals. Naturally we are taking part in the deal as merchants; but also, we are doing the adaptation and installation too, adding significant value to the products.

"In addition to what has been mentioned we are also offering real 'delicacies' which we got access to via our cooperation with HP. Our partner is in the forefront in the introduction of color technology in the PC world. Its unique products include a color, ink jet 300 dpi DeskJet printer which can handle 16 million colors and the A/4 scanner. As a surprise we will show a special plotter, but it is not yet decided whether those interested will find it at the Controll stand or at the HP&C stand.

"We will also offer new items in office technology. These will include Brother typewriters—four models—which customers will find equipped with Hungarian character sets. Controll is offering complete office equipment, from the armchair to the computer; we will deliver all sorts of equipment and office tools. Naturally this includes telephones. We will offer our customers digital exchanges and telephone sets which can be used for data communication as well."

FACTORY AUTOMATION, ROBOTICS

New RTS, TELEVEL Microcomputer Control Systems Described

92WS0125A Prague *AUTOMATIZACE* in Czech
Sep-Oct 91 pp 216-222

[Article by Eng Karel Kabes, Cakovice Equipment and Automation Plants [ZPA]: "New RTS and TELEVEL Microcomputer Control Systems"]

[Text] This article describes the new RTS 880 and TELEVEL microcomputer control systems, which have just been put in production. The RTS 880 control system is based on the I 8080 processor and has a bus structure with a central computer. It is designed for smaller, repetitive problem solving applications. The TELEVEL control system is based on the Z 80 processor, and has a hierarchical structure with dispersed intelligence.

Key words: Information, control system; RTS 800 and TELEVEL microcomputer control systems; telecontrol systems.

International decimal classification: 681.32:681.51

1. Introduction

Control, information, and telecontrol systems have for some years now been standard products at the Cakovice Equipment and Automation Plants [ZPA], government enterprise. This year the firm has introduced new microprocessor control systems known as the RTS 880 and TELEVEL, which were developed based on experiences with the manufacture and operation of TZD/TZS and MIKROLEVEL systems.

The two systems have different structures, designs, and implementations. The RTS 880 is a bus system with a central computer based on an I 8080 processor. TELEVEL is a multiprocessor system based on the Z 80 processor, with a hierarchical structure and dispersed intelligence. The systems also utilize different software. Programs for the RTS 880 control system are developed for each individual application using standard techniques and development systems. TELEVEL uses a modular program structure, with the most frequently used modules delivered with the system. This determines the main areas of application for each system. The RTS 880 control systems are appropriate for smaller, special purpose, repetitive applications. TELEVEL, on the other hand, is appropriate for extensive systems with host computers that have individual design and operational requirements.

2. RTS 880 Microcomputer System

The core of the RTS 880 system (see Figure 1) is a microcomputer made up of a single board control and communications processor (RKP01), a memory board (PMT01), a port board (PRT01), and an equipment converter board (TPR01). The processor (RKP01) collects information from the controlled equipment, performs control functions, issues commands to the equipment and, when necessary, executes remote data transmission to a control center. To support these activities it has available on the system bus (S-BUS) the PMT01, TPR01, and PRT01 boards.

The PMT01 memory board contains the system memory. It has a maximum capacity of 56 kB, and is expandable in 8 kB increments. The board is populated with type 6264 read-while-write [RWM] CMOS or type 2764 EPROM memory. Emergency power for the memory in the event of a power outage is provided by an installed nickel cadmium battery, which can power the memory for up to one week. The board also has a precise time clock, with an adjustable distinction capability of one minute.

The port board (PRT01) in the RTS 880 system is used to connect peripheral equipment. It is equipped with a parallel interface for an automatic calling unit and a

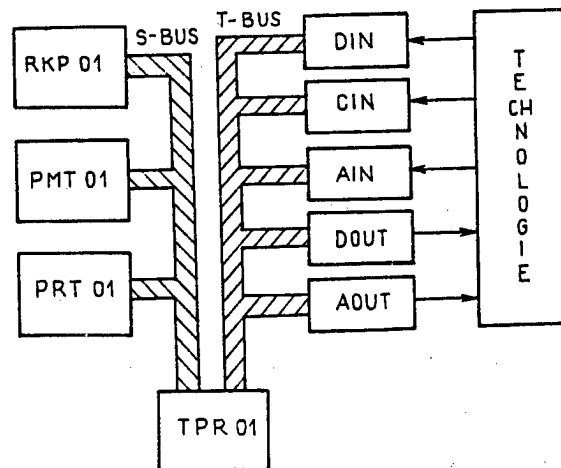


Figure 1. Block Diagram of RTS 880 Control System

Key S-BUS System bus—RKP01 Control and communication processor—PMT01 Memory board—PRT01 Port board—TPR01 Equipment converter—T-BUS Equipment bus—DIN, CIN, AIN, DOUT, AOUT Input/output blocks—TECHNOLOGIE Equipment

parallel interface for connecting a printer. CANNON type connectors are located on the front panel of the board.

The TPR01 equipment converter board (TPR01) provides the interface between the microcomputer system bus and the equipment bus (T-BUS) of the input/output system. It manages the different current levels in the two buses and decodes the addresses used to activate the T-BUS.

The microcomputer boards (RKP01, PMT01, PRT01, and TPR01) are the same size (6U), and are located and interconnected in a subrack of an LIP 01 processor, which is designed for installation in units with 19 inch fastening. The processor subrack is also the location for the DUE 005.2 power supply, and a DUE 050.2 stabilizer (manufactured by DECIN ZPA). There is also room for installing a link interface (modem).

An important part of the RTS 880 microcomputer system is the set of input/output blocks that are connected through the equipment bus (T-BUS) to the equipment converter (TPR01) (Figure 1).

This set includes:

- Digital input block (DIN)
- Counter input block (CIN)
- Analog input block (AIN)
- Digital output block (DOUT)
- Analog Output block (AOUT)

The DIN block handles the transmission of binary inputs from equipment to the microcomputer and its galvanic

separation. The input circuits are powered using the RTS 880 power supply, so that there need be only an open contact in the controlled equipment. Alternatively, the input circuits of the DIN block can be powered using an external power source.

The CIN block handles the counting of the impulses from the controlled equipment and the transmission of the impulse count to the microcomputer. The CIN block galvanically separates the equipment from the microcomputer and, just as the DIN block, can be powered either using the RTS 880 power supply or from external sources.

The AIN block converts input analog measurements from the equipment to 12-bit digital form and transmits them to the microcomputer, making sure that the equipment is galvanically separated from the microcomputer.

The DOUT block transmits binary outputs or commands from the microcomputer to the equipment. The

outputs are protected with a security code so that even if there is a problem with the equipment a false command cannot be sent. DOUT block outputs are organized in four groups of 14 commands each. The user has available either an active or a resting contact relay. To amplify the switching power a strip with a separation relay can be used.

The AOUT block converts the outputs of the microcomputer 8-bit digital/analog converter to an analog signal for controlling the attached equipment. The output analog signals can be either voltage or current, as required by the attached equipment.

Each of these input/output blocks is made up of control and functional modules which are mounted and interconnected to the T-BUS on I/O strips designed for mounting on racks with 19 inch fasteners. The RTS 880 input/output system is implemented by choosing functional modules for the I/O strips in the case, with the maximum numbers indicated on Table 1.

Table 1. Maximum Capacities of RTS 880 Input/Output Systems

512 binary inputs/outputs	Maximum of 4 LIO 01 strips, each for 128 inputs/outputs.
64 counting inputs	Maximum of 2 LIO 01 strips, each for 32 counters.
32 analog inputs (with 12-bit analog to digital converter)	Maximum of 2 LIA 01 strips, each for 16 analog inputs.
56 command outputs, in four groups	Maximum of 2 LOD 01 strips, each with two groups of 14 commands.
10 analog outputs (with 8-bit digital to analog converter)	1 LOA 01 strip.

The basic components of the RTS 880 microcomputer system, i.e. the LIP 01 processor rack and the I/O strips, are mounted in a case. The size of the case for each application is directly determined by the

capacity of the input/output system for the microcomputer. Available are one wall mounted case, and three floor cases for different numbers of I/O strips. See Table 2.

Table 2. Dimensions and Weight of RTS 880 Microcomputer System Cases.

Model	Type of case	Number of installable strips	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
RTS 2	Wall mount	2	1,000	600	400	30
RTS 4	Floor	4	1,600	600	400	70
RTS 8	Floor, 2-sided	8	1,600	600	400	80
RTS 10	Floor, 2-sided	10	2,000	600	400	90

Programs for RTS 880 systems consist of basic software for work in real time. To effectively develop user programs a development system is used that is designed for program development on 8-bit microcomputers. The development system is implemented using the IRIS-R language and its IR 80 compiler, which facilitates the development of control programs for the RTS 880. For typical, repetitive applications (for example in heating plants, air technology plants, etc.) the manufacturer can deliver the RTS 880 microcomputer system with the application programs.

The RTS 880 microcomputer system is designed for control of smaller heat generation and air technology facilities, power generation systems in industrial plants,

electrical conversion substations, warehouse management, etc. Figure 5 shows a typical application of an RTS 880 system for control of a common technical process.

The controlled equipment is connected to the system core through the DIN, CIN, AIN, DOUT, and AOUT input/output blocks. Because the individual pieces of input and output equipment are galvanically separated there is no danger of ground loops or undesirable coupling occurring. Galvanic separation also eliminates the introduction of amplified current into the microcomputer part of the system. This understandably contributes to a large extent to the error free and reliable operation of the entire automated control system. A keyboard can be connected to the system to enable operator contact with the controlled equipment, as well as a printer, operator, console, etc.

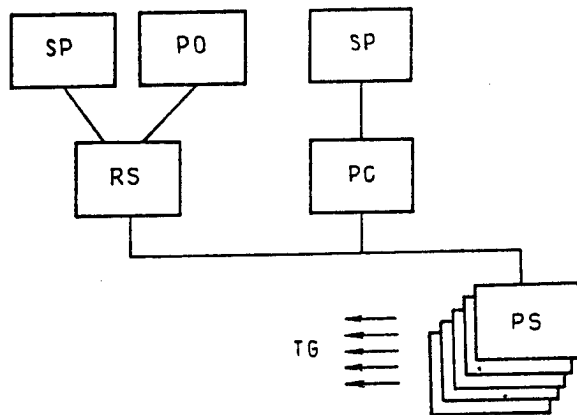


Figure 5. Use of RTS 880 Microcomputer System for Industrial Process Control

Key SP Standard peripheral—PO Operator panel—RS Control station—PC IBM XT, AT personal computers—TG Controlled industrial process—PS Subordinate stations (1-7)

The communications capabilities of the RTS 880 microcomputer can be used to advantage in automated dispatcher control systems. It is possible to build two-point or multipoint networks, and to transmit data for both fixed and switched connections. Up to seven subordinate stations can be part of the network, all connected to a single control station. The subordinate stations are configured as in Figure 5. The control station is then outfitted with additional dispatcher control equipment (handling table, checkerboard map, etc.). IBM PC/XT or AT class computers can also be used as a control station. The software for the control and subordinate stations is an important part of an automated dispatcher control system. This software must provide not only communications but also all system functions, distributing them efficiently to the individual stations.

3. TELEVEL Microcomputer System

In contrast to the RTS 880 system, TELEVEL has a multiple processor, hierarchical structure with so-called dispersed intelligence. This means that a limited part of the data is processed at each level of the system, with the results at lower levels then passed to a higher module for further processing. Based on the relationship of a given level to the process being controlled, TELEVEL has lower functions (DF) and upper functions (HF). The host computer is an independent part of the system (Figure 6).

The lower function subsystem (DF) is the closest to the process being controlled. Lower function modules are

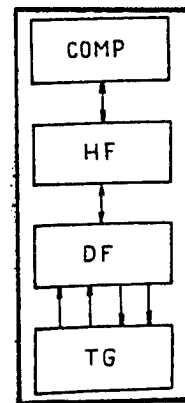


Figure 6. Hierarchical Structure of TELEVEL Microcomputer Control System

Key COMP Host computer—HF Upper function modules—DF Lower function modules—TG Process that is being controlled

based on DOPRO processor boards with a Z 80 processor and two output boards that provide the direct tie between the system and the process being controlled. The memory of the DOPRO processor board contains a set of memory resident program modules that handle not only the basic collection of data from the controlled equipment and its preprocessing, but also the output commands to the equipment being controlled and several simple control and automation functions. The design of each application need only determine which of these modules to use, in what order, and with which initial parameters, or simply determine the job parameters.

The data created by the called functions are stored in the DOPRO board memory and passed to the upper functions subsystem for further processing. Because all lower functions keep their data updated, regardless of whether an upper function immediately requires it, we call it a live data base. Data updates are performed at intervals of 1 millisecond or greater.

Different kinds of I/O boards can be connected to the DOPRO processor board. Table 3 contains a list of I/O boards suitable for lower functions. All boards galvanically separate the controlled equipment and are of uniform size (6U). The list of boards for lower function modules includes four-port shared RAM [random access memory], a board to provide synchronization and uniform time, etc. Through appropriate board configuration and program module selection one can use the lower functions to implement simple automation, filters, regulators, etc.

Table 3. Boards for Lower Function Modules

Board	Description
HYVST	Board for binary inputs. Allows the connection of up to 32 input signals with level L = - 72V to + 9V _{ss} and level H = + 19V to + 72V _{ss} . Maximum signal power requirement is 2 milliamperes. Possible to use an independent power supply through a free contact in the equipment.
REVYS	Relay output board. The board has 32 independent relay double throw contacts for a maximum switched power of 15W (maximum 72V _{ss} or 1A _{ss}). The board is also outfitted with a central output disconnect capability for troubleshooting emergency situations.
ANVST	Analog input board. There are two variants, one for direct inputs (A), and one for alternating inputs (B). Allows the processing of 8 input signals, with 12-bit analog to digital conversion. For variant A the inputs are galvanically separated with a basic range of +/- 250 mV. For variant B the inputs are not galvanically separated and have a basic span of +/- 5V. The basic spans can be modified easily. The conversion accuracy of the entire chain is 0.5 percent, with an overload tolerance of 120 percent of the nominal span value.
ANVYS	Analog output board. Available as a 3-channel board with 12-bit conversion, and a basic error of +/- 0.3 percent (A), and as an 8-channel board with an 8-bit converter and an error of less than +/- 2 percent (B). Outputs from both boards are galvanically separated with a rated span of +/- 10V or +/- 20 milliamperes.
ZDRCA	Uniform time board controlled by a OMA 50 kHz signal. Span of the information provided is from tenths of a millisecond to tenths of an hour, day, month, the last two digits of the year and designation of the day of the week. Time information is accurate to +/- 5 milliseconds.

The upper functions subsystem is hierarchically above the lower functions subsystem. A live data base forms the border between the lower functions and upper functions. The upper functions transform the live data base data into a so-called environment image, modify it according to supplied algorithms, and when necessary pass it to the host computer.

Upper function modules are made up of boards and at times other auxiliary equipment (power supplies, connecting cables, etc.). Table 4 provides an overview of the most important boards for upper function modules. For the most part they are specialized microcomputers based on the Z 80 processor with the same connections. They differ in structural design depending on the type of superordinate computer and in the memory resident programs.

Table 4. Boards for Upper Function Modules

HOPRO	Basic board for upper functions subsystem. A simple microcomputer based on the Z 80 processor with a 32 kB EPROM and a 64 kB dynamic RAM. Controls and utilizes the results of the work done by lower function modules, implements simple kinds of automation and control functions (PID regulation, logic engine, chokes, etc.).
MODEM	Specialized microcomputer based on the Z 80 processor, with an 8 kB EPROM and 1 kB static RAM for serialization, deserialization and data adaptation for serial communications. Serial data transmissions in various protocols, with various voltage and current levels, and in "point to point" or "multipoint" modes, are executed either independently or under HOPRO control. MODEM provides galvanic separation from serial lines and has the capability of relay dialing of telephone numbers on switched lines.
PRTAB	Specialized microcomputer based on Z 80 processor with an 8 kB EPROM and 64 kB dynamic RAM. Provides connection to DIMO 86 dispatcher checkerboard panel and, in conjunction with a PRPAR board, can be used as a data concentrator.
PRADT	Interface board with a specialized microcomputer based on the Z 80 processor, with 8 kB of EPROM and 64 kB of dynamic RAM for connecting an ADT type host computer. The board is part of ADT and has access to all connected lower function modules (to their live data bases) at distances up to 3,000 meters. Data transmissions is parallel, and by bytes.
PRSAP	Same as PRADT, but used to connect SAPI 86 host computer.
PRPAR	This board provides the termination of parallel, star connections of up to 3,000 meters using SYKFY or TZEKEZY cables. It provides galvanic separation of the connected stations from the cable and of the individual signals in the cable from each other.

When working with the TELEVEL system one must constantly keep in mind that the concept of upper function includes both the equipment and the requisite

program functions. Table 5 provides an overview of the upper function modules that are standard in TELEVEL systems for the most frequently performed functions.

Table 5. Most Important Upper Function Modules

Module	Name and Function
HF A	Instrumentation, regulation, control, and automation function. This module is made up of the HOPRO board. It can cooperate only with those lower function modules at the same station. Used to implement simple functions (PID regulators, logic engines, command blocking, wattmeter, etc.)
HF B	Remote transmission. This module is made up of a HOPRO and a MODEM board and can cooperate only with modules at the same station. Performs serial communication with remote stations by a selectable protocol.
HF F	Connection to ADT. This module is made up of the PRADT interface board for the ADT 4500/4700 minicomputer. It transmits data at speeds up to 40 kbits per second from up to 14 stations. The PRADT memory creates an environment image (data base) for the ADT minicomputer.
HF G	Connection to SAPI 86. Same description as the HF F module, but a PRSAP board is used instead of a PRADT. This module also enables connections to the DIMO 86 dispatcher checkerboard panel (that is, to its SAPI 86).
HF M	Parallel Data Concentrator. This module is made up of PRTAB and PRPAR boards. The PRPAR board can be used to connect in a star pattern up to 14 stations to a single PRTAB board. This allows at a single nodal station the processing of up to 14 x 192 bits (2,688 bits) of a controlled process.

The highest hierarchical level in a TELEVEL system is the host computer. The host collects from the upper functions subsystem updated environment images for comprehensive processing. The host computer is equipped for easy operator access (keyboard, display, printer), has high capacity external memory for archiving data, etc., and a real time operating system under which it performs all requested functions (modeling the controlled process, issuing commands, control and decision making algorithms).

Appropriate TELEVEL host computers of Czechoslovak manufacture include ADT 4700 minicomputers and SAPI 86 microcomputers. The DIMO 86 dispatcher checkerboard panel is a specialized host computer for constructing central control panels, dispatcher tables, etc. Foreign computers that can be used include all types of personal computers compatible with IBM PC/XT and AT, AEG computer systems (Z 300, ATMP 8016, ATMP 8032, MODCOMP), and new generation computer system with artificial intelligence, such as the ACA/32000 from the American firm ACA, Inc.

Lower and upper function modules can be used to configure stations that can facilitate the building of systems in specific applications. At each station several modules work together, with each one performing a specific, specialized function. Three basic station types can be identified, based on purpose:

- TLVL 90 Process Station (PS).** Process stations can contain up to three lower function modules and three upper function modules (Figure 8a). At maximum configuration, a PS can process 192 binary or 48 analog signals, or commands, and can be connected to up to three independent computers. The upper function modules can perform instrumentation functions, simple automation, and serial/parallel transmission channels.
- TLVL 90 Control Station (RS).** Control stations can contain up to two lower function modules and two upper function modules (Figure 8b). One can also mount at an RS station SAPI 86 microcomputer boards, which can be programmed by the user to

perform automation and control functions based on required algorithms. Up to 14 RS can be connected in parallel.

- TLVL 90 Serial Concentrators (SK).** Serial concentrators contain no lower function modules, and can have as many as two upper function modules for remote transmission, with a maximum of 10 transmitting and ten receiving lines (Figure 8c). A serial concentrator can be connected to two independent host computers (for example an ADT 4700, a SAPI 86, an IBM PC, etc.).

Individual types of stations can be connected using serial and parallel communications lines. This allows users to

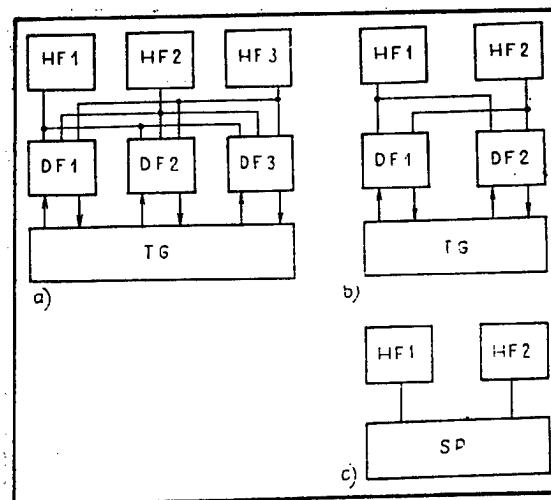


Figure 8. TELEVEL Microcomputer System Stations

Ky a) TLVL 90-PS Process Station—b) TLVL 90-RS Control Station—c) TLVL 90-SK Serial Concentrator—DF1-DF3 Lower function modules—HF1-HF3 Upper function modules—TG Process being controlled—SP Serial transmission

create configurations ranging from simple, point to point connections of two stations, to very complex, multiple level, star implementations. See Figure 9.

For powering the functional parts of the TELEVEL system a high performance power supply with modular construction is available. Depending on user requirements, the power supply can be provided input alternating current of 220V +/- 10 percent, or for direct current of 220V, 110V, 60V, 48V, or 24V +/- 15 percent. Maximum output is rated at 200 VA, or 200W. Output current is delivered by 12V/4A or 5V/6A power boards in the requisite configuration.

An important part of the modular TELEVEL system is the set of cartridges, cabinets, distribution cabinets, auxiliary terminal boards, etc., that facilitate the installation of functional modules and stations for specific applications. Mechanical assembly conforms to the IEC size standards and the fastening holes of all components are spaced 19 inches apart. To assure high reliability the individual functional parts are designed as circuits and constructed so that no fans are needed for forced component cooling. A special cartridge, a so-called thermobox, is available for use under extreme conditions. It is equipped with automatic ventilating and heating equipment that will allow stations to be operated in a temperature range of - 20 to + 45°C (without fans). A thermobox can be mounted in all cabinets and floor

units, has fastening holes 19 inches apart, or can be wall mounted with aid of a console.

When the TELEVEL system was designed, the ease with which it could be incorporated in user applications was an important consideration. This is provided by the wide assortment of available boards, functional modules, stations, auxiliary equipment, and program modules. All microcomputers for the functional parts of a TELEVEL system are programmed at the factory. These programs provide the functions offered by the equipment. The user project team only specifies desired functions and these are then developed for each specific use. Only the host computer has to be individually programmed, but it is usually equipped with state of the art development tools.

To make the design of a TELEVEL system easier an expert design program, called TELEVEL, has been developed in cooperation with the machinery department at the Czech Technical College [CVUT], for use with IBM PC/AT computers. The program allows the design of all information about the system, and uses dialogs to guide the user through the selection of both hardware and program modules. The result of the design, in addition to the usual diagrams and written materials, includes so-called parameter setting lists, which contain the data needed to adapt the standard programs on the microcomputer boards for a specific application. The TELEVEL system comes with a number of autodiagnostic functions that improve its operational reliability as well as facilitating hardware repairs and maintenance. For example, all operations are executed using vertical parity, read only memory is equipped with check sums, a watch dog circuit monitors program execution, and the power supply is monitored continuously to assure that the current is within acceptable ranges. Tests are constantly running in the background during normal operations, and it is also possible to request special tests.

Because of its wide range of compatibility, the ease with which it can be adapted to user requirements, and its advanced design with a well thought out hierarchical organization, TELEVEL offer wide installation opportunities. The main areas of application are production, the distribution of electricity and heat, manufacturing and industrial process control, and the extensive field of ecology (waste water treatment plants, separators, etc.).

Conclusion

The Cakovice ZPA government enterprise sells the TELEVEL and RTS 880 systems in configurations suitable for industrial environments and offers its customers comprehensive service related to the implementation and operation of both systems. These services include project design, installation and system tests at the user's site, and service for production failures. The firm also sells systems based on specifications developed by customers or consulting firms hired by customers. Cakovice ZPA pays a lot of attention to the professional training of the technicians at future user firms, so these personnel

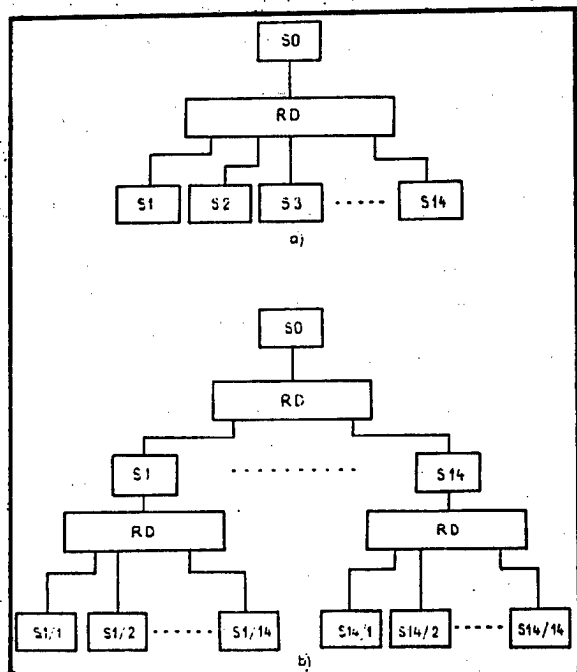


Figure 9. Interconnection of TELEVEL System Stations
Key a) single level—b) multilevel—S0-S14, S1/1-S1/14, S14/1-S14/14 Televel system stations—RD Auxiliary adapter board

can be ready to make optimal use of the hardware and software of the delivered system.

LASERS, SENSORS, OPTICS

Hungary: MFKI Develops Advanced Laser Diode

92WS0054A Budapest MAGYAR ELEKTRONIKA
in Hungarian Apr 91 p 48

[Article by B. L.: "New Laser Born at the MFKI [Technical Physics Research Institute]"]

[Text] Hungarian microelectronics can boast of few really significant achievements. The new type of laser diode developed at the Technical Physics Research Institute (MFKI) does not belong among the lucky developments; its fate is most uncertain. But an achievement at the world level has been born here! The only trouble is that main department chief Odon Lendvay, who directed the development and managed the theme, has died—as a result of an automobile accident. Since he held everything in one hand, his death has broken those links which would have made industrial use of the achievement possible.

The fact that, despite its relatively serious technical backwardness, they succeeded in developing at the MFKI a device which can count on world interest is certainly of great significance. The development, supported by the OMFB [National Technical Development Committee], was aimed at developing a light source used in optical fiber communications; it can be well integrated into such systems and it results in outstanding transmission. We talked with Vilmos Rakovics, of the MFKI, about the theme.

"The MFKI began to deal with semiconductors in the 1960's. The Institute had made the first light emitting diodes in the 1970's, and later this led to the laser diode. With the development of GaAs based devices, there developed a technological culture which made it possible for people at the Institute to master all those operations (liquid phase epitaxial layer growth, contact preparation, slice cutting) which are used in making such devices.

"Odon Lendvay decided to develop a laser diode which was suitable for telecommunications purposes. This meant that he needed a device that would radiate in a region best suited for optical fiber, with minimal attenuation. Attenuation has two minimums in the spectrum of optical fibers—one is at 1.3 microns and the other at 1.55 microns."

When the theme got started the people at the MFKI were already behind compared to the world. This prompted them to jump straight into the middle of the theme, not to experiment on the model structure but rather to try to create a live, operable device. They already knew what they wanted to do, so they did the model computations until the materials arrived.

The device has seven layers. The substrate is InP. The epitaxial layers are grown on this. Between the two larger forbidden band layers is placed a smaller forbidden band active layer, and this emits the light. The laser effect is produced by the fact that the slotted edges of the device act like mirrors. As a result the size of a chip can be 200-300 microns.

What is new in the structure of the device developed by the MFKI is that it is completely smooth, there are no fractured surfaces at the border of the active zone. The problem with InP based lasers, in general, is that the current disperses below the metal strip and so the current density decreases, the chip heats up and so, finally, efficiency decreases. Various modes can easily develop in the output radiation, interference is produced and the connection into the optical fiber will be worse. To avoid these problems, one must make a laser in which the cross section of the active layer is under 0.3 square microns. This can be done only if one creates a very narrow wave guide, that is a strip with a very small cross section. Traditionally this is done by scoring (mesa like) this strip. The MFKI technology avoids the development of fractured surfaces which are created during scoring. All the current is concentrated on a very small area and the light is concentrated in the GaAsP layer. Such a laser has very good efficiency and mode selection.

We succeeded in learning about the technology that the biggest "trick" is to first score the carrier and then to grow on it an epitaxial layer of the same type as the carrier. This "heals" the scoring "wounds" so that the entire p-n junction is made on a surface of outstanding quality. With this method it is possible to have no damaged surfaces on the border of the active zone.

There are many such buried layer laser diodes on the market but the MFKI device is among the best. This is proven in part by the test results and in part by the fact that the life expectancy is substantially greater—due to the one step growth—than for devices made by scoring. And the technology is even cheaper, due to the one step growth.

What will happen with this device? The people at the MFKI still do not know. The domestic market is too small to make it possible to manufacture it economically. It is most probable that the patent will have to be sold—a large manufacturer has already expressed interest. But this would not be the real deal.

TELECOMMUNICATIONS

Hungary Linked To International Data Exchange Network

92WS0108A Budapest FIGYELO in Hungarian
10 Oct 91 p 27

[Article by J. K.: "Changing the System"]

[Text] Earlier when we talked about computerized data transmission everyone smilingly thought, in many cases, that someone got a floppy and then the printed out data and then personally carried it to the addressee. Later the possibilities changed a little. The IIF [national research and development] packet switched data transmission system was realized as an original development, something like the Hungarian orange in Peter Bacso's film "The Witness"—it was little and it was sour, but it was ours! That is, it was if you tried to do something serious with it.

The system change and the easing of the embargo have made it possible to think seriously here also of introducing a packet switched data transmission service connected to international data traffic. This will make it possible to connect the user and the computer databanks more quickly and substantially more cheaply than on a traditional telephone line. At the same time it would probably create a possibility for such services as, for example, the physical separation of a printing press and the composing systems or linking the editorial offices of papers published in several different places.

With the Hungarian Post Office breaking up into special branches and being reorganized, a favorable opportunity has been created for the transformation to take place very quickly, virtually instantly by Hungarian standards. Due to the peculiarities of the legal regulation at present computerized data transmission now is the province of Please Ltd., recently separated from the Hungarian Telecommunications Enterprise, and they immediately set about realization of a program begun earlier at MATAV [Hungarian Telecommunications Enterprise]. Users will be able to experience the first steps of this within days when the first Siemens made packet switching center goes into operation in the Budapest Varoshaz utca building of the Main Post Office. This will make the services of the Hungarian system equivalent to those of Deutsches Telecom, the West German data transmission enterprise.

The first measure taken by the new leadership was to reduce, effective 1 September, the entry fee for a data terminal connecting by direct line from the earlier 150,000 forints to 50,000 forints, in return for which they will bring the necessary lines to even the most isolated site, if it is technically feasible. (When will the MATAV telephone business make such a favorable decision?) Then it will be possible for the user to connect by direct line to the data switching center. Those who cannot spare so much at first need not fear for it is also possible to get into the system on a normal dial telephone line. (Here the base fee is 600 forints per month.)

In contrast to earlier systems this one will make it possible not only to initiate a call from the data stations but also for someone to call the data station—if the user does not rule this out by a special request. Various logical channels for the physical links can be installed for the one-time entry fee; that is, more data link call numbers are possible, provided in return for a 150 forint fee per channel.

With the system it is possible to access large foreign databanks and to create data links directly with the computers of associated foreign enterprises. In this case, naturally, one must first come to an agreement with the owner of the receiving system to get entry passwords and access rights. The data transmission system only guarantees the accessibility of other systems; entry there, use of them, and the fees to be paid must be negotiated directly with the owner of those systems.

In contrast to earlier systems this one appears to be really useable for the equipment they are getting is the same as that to which the West German Post Office is switching from the earlier well thought of Datex-p network system. In the case of moderate use one data switched terminal means an expense of about 20,000 to 25,000 forints for the subscriber. Experience shows that this will pay for every small firm or private subscriber who up to now has called the Radio Austria system directly on a Vienna telephone number, or thus reached a Western databank.

As the system goes into operation we have succeeded in linking into the data circulatory system of Europe and the world. Perhaps not only foreign entrepreneurs but domestic ones as well will recognize this new opportunity.

Hungary's MATAV Analyzes Present, Future Development

92WS0113A Budapest COMPUTERWORLD/
SZAMITASTECHNIKA in Hungarian 17 Oct 91 p 25

[Article by Huba Bruckner: "MATAV, They Have Enough Plans"]

[Text] The opening talk at the EEMA conference was given by Pal Horvath, director general of the Hungarian Telecommunications Enterprise [MATAV], with the title "MATAV In The Service of Progress (and Transformation)." He reviewed the present status of the services and then summarized the three-year development plans of MATAV.

In the years between 1986 and 1990 (this was the period of the Seventh Five-Year Plan), they installed more than 400,000 new telephone lines, the conversion to digital technology began, and they made preparations to formulate and realize a longer term developmental plan. In January 1989, for the first time in the region, regulation and operations were separated at the Post Office. The way was opened for private investors, who could acquire ownership rights, up to 49 percent, in providing Hungarian telephone service. The Post Office was transformed into three independent enterprises: the Hungarian Telecommunications Enterprise, the Hungarian

Broadcasting Enterprise, and the Hungarian Post Office Enterprise. The next station in the development of MATAV was its conversion into a joint stock company.

Telecommunications At Present

As of the end of last year about 1 million telephone stations were in operation. Of these 80,000 lines were created in the past year, in 1990, which corresponds to an annual 8 percent increase. Although this is the highest value in recent years, it still lags behind data characteristic of developed countries. Therefore, we cannot be satisfied with the growth index, because in the meantime the number of those waiting for lines grew significantly. At the end of 1990, there were 607,000 on the waiting list, of whom 253,000 were in Budapest. The average waiting time is 12 years. (It is estimated that in Hungary today there is a need for at least 1.5 million lines in addition to those existing, two and a half times the present capacity.)

The very large proportion of shared service lines further reduces the value of the existing line capacity. (This index is especially bad in Budapest.) The existence of shared service stations simply cannot be continued as these cause a deterioration in the level of services. Thus in the future, in-so-far as possible, only main lines should be installed. After 1993, one can count on a reduction in the number of existing shared service lines as the old exchanges are replaced.

Only automatic telephone exchanges operate in Budapest now, but in the provinces only 88.5 percent of the lines are connected automatically. Half of the telephone subscribers in Hungarian villages are still served by manually connected exchanges. This also means that they can use their telephones only from 8 in the morning until 4, or in a better case 6, in the afternoon.

Of the existing lines 87.4 percent can be used for domestic long-distance calls and 71.4 percent are linked into the international long-distance network. Seventy-five percent of the Hungarian towns—but only 34 percent of the villages—are connected to the domestic long-distance network.

The mobile telephone has been a real success. Since the service was introduced in October 1990, the number of subscribers has increased, as of July 1991, to 4,500. Since summer the service can be used not only in Budapest and environs but also along the M7 highway and in the Balaton area, along the M1 highway, and in Miskolc and in the zone of the road leading to Miskolc.

Of those services not based on speech the experimental packet switched network had 200 data stations at the end of 1990, and the number of these may increase by an additional 200 or 300 stations by the end of 1991.

Although the number of telex stations is increasing at present, and this trend can be expected in the coming years too, the telex traffic is gradually decreasing. The number of stations is now 14,500. An SFU (Store and

Forward Unit) system was put into operation in 1990; this makes possible the introduction of modern telex services. The telex-teletex converter also began its work last year. (Teletex is actually a modern version of telex—passing on messages from storage to storage.) It can be seen clearly today that throughout the world teletex has proven to be a deadend, while telefax has been more successful than expected. At the end of 1988 there were 1,057 fax subscribers in Hungary; their number increased by 4,661 in 1990—in one year—and at the end of last year the number of fax subscribers reached 9,693. The fast growth trend will continue.

So far the domestic appearance of CEPT [European Conference of Post and Telecommunications] standard videotex has found a most mixed reception. A more significant increase in the number of subscribers is hoped for with the spread of DECODIX software which makes personal computers suitable for a videotex mode. And interest would certainly increase if there were more data stations of general interest and if the accessibility of international services were solved. On the other hand, Minitex, which offers the simplest message service, has been successful; for this one can use portable terminals with acoustic connections. At the end of 1990, the number of subscribers was 428; in 1991 technical conditions were created to expand the number of terminals to 800. Subscribers not only can call one another but also can call telex subscribers anywhere in the world.

A Three-Year Development Plan

MATAV published its three-year plan in October 1990 and modified versions of it were prepared in February and June of this year. It appears unambiguously from this that they will continue to strive for a leading role in the area of communications and that they are counting on very significant foreign capital to realize the plans.

A modernization of the basic network is a precondition for these developments. Two-thirds of the main line network will be built up with optical cable. They plan to install about 2,500 kilometers of optical cable. The rest of the network will use digital microwave connections. This latter will represent the bridging of about 1,500 kilometers.

At present four of the 19 counties are reached by digital transmission lines, or digital switching exchanges are used in them. An additional six county seats will be connected into the digital basic network in 1992 and the remaining nine will be connected in 1993.

In the three-year period MATAV plans to create 150,000 crossbar switching telephone lines and 490,000 digital switching lines. Some of these lines are intended to modernize existing lines. So the total capacity expansion is not the sum of the two numbers (640,000) but rather 554,000.

According to MATAV estimates other operators may create about 400,000 new lines. So the actual line capacity of the country—taking into consideration modernization of existing lines as well—may reach 1.5 to 1.75 million by 1993.

By 1993 seventy percent of the telex subscribers will be linked to the international network via electronic switching centers. MATAV also plans to provide domestic users with artificial satellite data transmission possibilities to satisfy high-speed data transmission and video-conference needs.

Construction of the first data transmission earth station can be expected this year.

Use of digital technology is already a natural requirement at the level of subexchanges. MATAV plans to solve the creation of subexchanges with Comex. Very strong competition can be expected in this area.

By the end of 1993, the Westel NMT 450 mobile telephone service may have 50,000 subscribers. In addition to the 450 megahertz frequency range Westel will try for a leading role in 900 megahertz radiotelephony.

Radiocontact is the name of MATAV's paging service. Those who prepared the development plan consider it conceivable that the number of subscribers to the service may reach 32,000 by the end of the three-year period, or by New Year's Eve 1993. The firm also plans to build and operate a cable television network.

The plan reckons that in addition to domestic traffic there will also be an increase in the need for international speech and nonspeech services. In all certainty the growth indexes for nonspeech services will be greater percentage-wise.

Finally it is worthy of note that when preparing its plans MATAV strove to follow the international standards and trends, which cannot be imagined without close cooperation with various international organizations. The EEMA is one of these organizations.

Hungary: Orion Electronics Company Survival Weighed

92WS0126A Budapest MAGYAR ELEKTRONIKA
in Hungarian Oct 91 pp 31-32

[Article by Bela Laczkó: "What Will Happen With New Developments at Orion?"]

[Text] If we are talking about the Hungarian electronics industry, we simply wave our hand sadly and say, "It is in ruins." The question is, what will happen? Will the government liquidate every state electronics enterprise? Can a way out be found within the factory? Can a large indebted enterprise get on its feet without help?

Sandor Tatar, telecommunications chief engineer for Orion, invited us to a conversation where these questions were examined from his own (Orion's) viewpoint. He showed us the new equipment the future of which is doubtful, although it was recently developed.

"In 1989 we still had capacity problems in satisfying orders for telecommunications equipment. Then, with stormy speed, those changes took place in the course of

which the main pillars of Hungarian industry, including electronics, collapsed. At Orion too computer technology shrank with great speed until today only telecommunications remains out of the professional profile.

"The dwindling of computer technology, due to overproduction or Far East dumping, is a national, indeed a European, phenomenon. Increasingly the domestic firms sell only the products of others.

"Although there is a great fight for the market in telecommunications as well a number of countries, including ours, are carrying out a gigantic telecommunications development program which is briefly called digitalization. Orion prepared for this in time and it has the modern digital microwave equipment which, deviating from earlier practice, not only provides a transmission path for multiplexed telephone channels but also can connect directly through its own PCM [pulse-code modulation] multiplexers to lines between subscribers or telephone exchanges. In addition it can be used very economically for data transmission also. The product assortment now includes line units the large number of which makes possible better yield series manufacture."

As the chief engineer showed in what was being manufactured the guiding principle in developing the designs was to reduce as far as possible, compared to equipment manufactured earlier, the need for purchased materials and for live work. The MIKROLINK family was based on the technical solutions for artificial satellite reception and the parts base therefor. The transmitter-receiver is connected directly to the antenna (and not via a long, high attenuation feed line), just as in the most modern Western equipment. The difference is that the circuits outside are those which are absolutely necessary (the last stages of the transmitter and the first stages of the receiver), so the expensive miniaturization was omitted and operation was simplified in that a larger part of the equipment operates inside.

The weight and size difference with the new equipment—compared to the old equipment which can still be found in final testing—is striking, as a result partly of these design principles (a smaller transmitter output need and smaller consumption) and partly of the general use of integrated circuits.

"We cannot abandon these achievements, aggressive market action is needed, because according to the sad experiences of the branch we can count only on ourselves. The question is, do we have enough time?

"We must reckon not only with price competition but also with all the difficulties of winning a market. A good example of this is our IER equipment developed in cooperation with the TKI [Telecommunications Research Institute] at a cost of many tens of millions. The OMFB [National Technical Development Committee] also offered support for this (from money saved from all of us!)," Sandor Tatar said.

"Although this equipment is equivalent in every respect to the original French equipment on the basis of which the predecessor of the present MATAV [Hungarian Telecommunications Enterprise] started the development, even today there is receptivity for it only in words, import continues unchanged, and there has been no change in the network development plans. And not only is the price of this model suitable, but also, because of its special services, it has real prospects on both the domestic and foreign markets. It works like a digital subexchange, but it is supplemented by a microwave transmitter-receiver which also ensures a subexchange-link and provides a direct link for subexchanges (line concentrators) operating in neighboring regions. A system made up of the IER equipment, branching like a tree, also containing repeater stations as needed, could be county-wide or national in extent. A special advantage is that the connection of subscribers with one another is ensured within the system, without making use of the Postal exchange (and the fee therefor). It is also advantageous that as a result of the central control (PCM-TDMA) the transmitters 'talk' one after another in a time-sharing fashion, so the entire system—even with 128 subscribers—uses the same frequency pair (transmitter-receiver)."

"Such equipment is needed in many places in the country for the famous 'village program'; however, we have not had the opportunity even to build a reference system in Rackeve, where it was originally planned by the Post Office (at the cost of millions!). Is there no money for a sample system or even for preparing the area, when we are getting a hundred billion in credits to develop the telecommunications network? So for lack of a better we set up a reference connection between the TKI and Orion. The authorities, of course, may not

participate in the approval tests and may forbid the radio link and/or connection to the public network. In the meantime the costs continue to grow, and it may be that the free lines being reserved (?) for IER may have been used up in Rackeve.

"The authorities are raising additional difficulties in connection with certifying the model. According to a ministerial decree (8/1991. III. 14.) the model certification which can be obtained by an expensive testing procedure is not enough for the sale of telecommunications terminal equipment, there is a 1 percent fee to be paid and an additional (?) 2.5 percent—exclusively held back from this income—which according to the authorities must be paid for every single unit sold.

"There is no doubt about what this means for domestic manufacturers (an import tax on parts, a 40 percent interest on credit, a 25 percent AFA tax, 43 percent TB, wage grossing, profit tax, etc.) and ultimately for the consumer, especially when the concept of terminal equipment is interpreted by the authorities even more broadly than their own declaration (see MAGYAR TAVKOZLES, number 7, 1991).

"Similar dangers accompany that provision (X. 16. Section 2.) of the frequency management law soon to come on the agenda according to which: 'The minister determines the system of model testing and certification.' All this not only makes it difficult to get onto the domestic market, if we have no domestic references what chances can we have for export? More and more manufacturing enterprises interested in telecommunications may be asking this question."

Dear readers, and those responsible! The editors add to what Mr. Tatar had to say only what is necessary, that naturally we will also give space to other opinions.

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